COURSE GUIDE

DNT 306
DENTAL PROSTHETICS

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INTRODUCTION

DNT 306: Dental Prosthetics is a three credit unit course for students pursuing a degree in dental technology. It is broken down into four modules and 21 units. Dental Prosthetics is a basic course in the study of dental technology because it sets the tone, offers the direction and the principles upon which success in the practice and study of dental technology predicates.

WHAT YOU WILL LEARN IN THIS COURSE

The course content consists of a unit of the course guide which tells you briefly what the course is all about; what course materials you need and how to work with such materials. It also gives you some guideline on the time you are expected to spend on each unit in order to complete it successfully.

It guides you concerning your tutor-marked assignments which will be placed in the assignment file. Regular tutorial classes related to the course will be conducted and it is advisable for you to attend these sessions. It is expected that the course will prepare you for the challenges you are likely to meet in the field of dental technology.

COURSE AIM

The aim of this course is to give you an in-depth understanding of dental technology which includes the definition and scope as well as the procedures, technical considerations and basic requirements for the achievement of desired goals in the day to day work of dental technology. It is intended to let you into appreciation of the fact that dental technology is the beauty of dentistry.

COURSE OBJECTIVES

Note that each unit has specific objectives. You should read them carefully before going through the unit. You may want to refer to them during your study to check on your progress. You should always look at the unit objectives after completing a unit. In this way, you can be sure that you have done what is required of you by the unit.

However, below are overall objectives of this course.

At the end of this course, you should be able to:

- discuss dental technology and it’s sub sections or units making it up

- distinguish between deciduous and permanent dentition
- identify and distinguish the various teeth and their functions in the mouth
- discuss the concept of impression, impression taking and enumerate the various impression handling techniques as well as ideal impression
- explain model separation, duplication and trimming techniques
- explain the concepts of special tray; materials and methods of their construction
- discuss the concept of bite registration and explain the importance of marks on registered bite block.

WORKING THROUGH THIS COURSE

To complete this course, you are required to read each study unit, the recommended text books, and other relevant materials which may be provided by the National Open University of Nigeria (NOUN). Each unit contains self-assessment exercises and tutor- marked assignments. There is also a final examination at the end of this course. Stated below are the components of this course and what you have to do.

COURSE MATERIALS

The major components of the course are:

1. Course Guide
2. Study Units
3. Textbooks and References
4. Assignment file
5. Presentation Schedule

STUDY UNITS

There are 21 study units and four modules in this course. They are:

Module 1 Overview and Scope of Dental Technology

Unit 1 Definition and Scope of Dental Technology
Unit 2 Prosthodontic Technology
Unit 3 Maxillofacial Technology
Unit 4 Orthodontic Technology
Unit 5 Conservative Technology

Module 2 Law of Form and Function

Unit 1 Characteristics Arrangement of Teeth
Unit 2 Dental Formula
Unit 3 Deciduous Teeth/Dentition
Unit 4 Permanent Teeth/Dentition
Unit 5 Tooth Morphology
Unit 6 Functions of the various Teeth in the Mouth

Module 3 Model Making in Dental Technology

Unit 1 Concept of Impression Taking
Unit 2 Impression Handling and Casting Techniques
Unit 3 Model Separation and Trimming Techniques
Unit 4 Model Duplication: Concept and Techniques

Module 4 Special Tray and Bite Registration Block

Unit 1 Overview of Special Tray Construction
Unit 2 Materials and Procedures for Special Tray Construction
Unit 3 Bite Registration Block: Overview
Unit 4 Materials and Methods of Constructing Bite Registration Block
Unit 5 Maxillomandibular Relationship Recording and Marks
Unit 6 Mounting of Registered Bite Block

RECOMMENDED TEXTS

These texts will be of immense benefit for this course:

Andlaw, R. J. & Rock, W. P. (1996). *A Manual of Pediatric Dentistry*. Edinburgh: Churchill Livingstone.

Anthony, J. *et al.* (2003). The Dimensions of Occlusal Registration Blocks. *Quintessence Journal of Dental Technology*. (QJDT) 1, 1, pp. 44-49.

Arnold, Hohmann & Werner Hielscher (2001). *Introduction to Dental Technology* (Translated 2003). QJDT1;1, pp.75-85.

Arthur, H. Bulbulian (1973). *Facial Prosthetics*. Springfield Illinois: Charles C. Thomas Publisher.

Ash, M. M. (1984). *Wheeler's Dental Anatomy, Physiology and Occlusion*. Philadelphia: W. B. Saunders Company.

Blakeslee, R. W. *et al*. (1980). *Dental Technology: Theory and Practice*. St. Louis Missouri: The CV Mosby Company.

Combe, E. C. (1977). *Notes on Dental Materials*. Edinburgh: Churchill Livingstone.

Craig, R. G. (Ed.). *Restorative Dental Materials*. St. Louis: The CV Mosby Company.

Craig, R. G. *et al*. (1975). *Dental Materials: Properties and Manipulation*. St. Louis: The CV Mosby Company.

Ferrcane, J. L. (2001). Materials in Dentistry: Principles and Application. Baltimore: Lippincott Williams and Wilkins.

Grant, A. A. & Johnson, W. (1992). *Removable Denture Prosthodontic* .(2nd ed.). Edinburgh: Churchill Livingstone.

Helmut, Holt & Martin, Kuske (2004). Working with Gypsum. *Dental Dialogue*. Vol.4-1.

Henderson, D. & Steffle, V. I. (1996). *McCracken's Partial Denture Construction: Principles and Techniques*. St. Louis: The CV Mosby Company.

Hudis, M. M. (1977). *Dental Laboratory Prosthodontic*. Philadelphia: W. B. Saunders Company.

John, Farrel (1971). *Partial Denture Designing* (2nd ed.). London: Henry Kimpton Publishers.

John, Osborne & Wilson, H. J. (1970). *Dental Mechanics for Students* (6th ed.). London: Staple Press.

Klaus, Dittmar (2004). A Systematic Approach to Partial Denture Fabrication. *Dental Dialogue* ,Vol. 4-1.

Macgregor, A. R. (nd). *Clinical Dental Prosthetics.* (3rd ed.). Wright.

Martinelli, N. (1975). *Dental Laboratory Technology*. St. Louis: The CV Mosby Company.

Morrow, R. M. et *al.* (1980). *Dental Laboratory Procedures: Complete Dentures*. St. Louis: The C V Mosby Company.

Neil, D. J. & Walter, J. D. (1997). *Partial Denture Prosthetics*. Oxford: Blackwell Scientific Publications.

Shaw, F. G. & Scott, D. C. (1968). *Practical Exercise in Dental Mechanics*. London: Henry Kimpton.

Tooth Numbers. *Quintessence Journal of Dental Technology* (QJDT). 1 (1) 86 (2003).

Veeraiyan, D. N. *et al.* (2003). *Textbook of Prosthodontics*. New Delhi: Jaypee Brothers Medical Publishers.

William, R.. P., Henry, W. F., James, L. A., Paul, M. T. & Tulloch, J. F. C. (1986). *Contemporary Orthodontics*. St. Louis: The CV Mosby Company.

ASSIGNMENT FILE

The assignment file will be given to you in due course. In this file, you will find all the details of the work you must submit to your tutor for marking. The marks you obtain for these assignments will form part of your total score for this course.

PRESENTATION SCHEDULE

The presentation schedule included in this course guide provides important dates for attending tutorials and the timely completion and submission of your tutor-marked assignment. You should therefore try to meet the deadlines.

ASSESSMENT

There are two aspects to the assessment of this course. First, there are tutor-marked assignments; and second, the written examination.

You are expected to apply knowledge, comprehension, information and problem solving gathered during the course. Your final TMA will be presented in e-format and this account for 30% of your exam score. At the end of the course, you will need to sit for a final written examination. This examination will account for 70% of your total score.

TUTOR-MARKED ASSIGNMENTS (TMAs)

You are expected to attempt all the TMAs in your study material. However, four TMAs will be uploaded in your portal. The best three will count towards your final exam grade.

FINAL EXAMINATION AND GRADING

The final examination for this course will take two hours and have a value of 70% of your total course grade. The examination will consist of questions which reflect the self -assessment exercises and tutor-marked assignments that you have previously encountered. Furthermore, all areas of the course will be examined. It is also better to use the time between finishing the last unit and sitting for the examination, to revise the entire course. You might find it useful to review your TMAs and comment on them before the examination. The final examination covers information from all parts of the course.

COURSE MARKING SCHEME

The following table lays out how the actual marking scheme is broken down.

Table 1: Course Marking Scheme

Assessment	**Marks**
TMAs 1-4	30 %
Final Examination	70%
Total	100%

COURSE OVERVIEW

This table indicates the units, the number of weeks required to complete them and the assignments.

Table 2: Course Schedule

Units	Title of Work	Weeks Activity	Assessment (End of Unit)
	Course Guide	Week 1	
Module 1	**Overview and Scope of Dental Technology**		
Unit 1	Definition and Scope of Dental Technology	Week 1	Assignment 1
Unit 2	Prosthodontic Technology	Week 2	Assignment 2
Unit 3	Maxillofacial Technology	Week 3	Assignment 3
Unit 4	Orthodontic Technology	Week 4	Assignment 4
Unit 5	Conservative Technology	Week 5	Assignment 5
Module 2	**Law of form and function**		
Unit 1	Characteristics Arrangement of Teeth	Week 6	Assignment 6
	Dental Formular	Week 6	Assignment 7
Unit 2	Deciduous Teeth/Dentition	Week 7	Assignment 8
Unit 3	Permanent Teeth/Dentition	Week 7	Assignment 9
Unit 4	Tooth Morphology	Week 8	Assignment 10
Unit 5	Functions of the Various Teeth in the Mouth	Week 8	Assignment 11
Module 3	**Model making in dental technology**		
Unit 1	Concept of Impression Taking	Week 9	Assignment 12
Unit 2	Impression Handling and Casting Techniques	Week 9	Assignment 13
Unit 3	Model Separation and Trimming Techniques	Week 10	Assignment 14
Unit 4	Model Duplication: Concept and Techniques	Week 10	Assignment 15
Module 4	**Special tray and bite registration block**		
Unit 1	Overview of Special Tray Construction	Week 11	Assignment 16
Unit 2	Materials and Procedures for Special Tray Construction	Week 11	Assignment 17
Unit 3	Bite Registration Block: Overview	Week 12	Assignment 18
Unit 4	Materials and Methods of constructing Bite Registration Block		Week 12 Assignment 19
Unit 5	Maxillomandibular Relationship Recording and Marks	Week 12	Assignment 20
Unit 6	Mounting of Registered Bite on Articulator	Week 12	Assignment 21

HOW TO GET THE MOST OUT OF THIS COURSE

In distance learning, the study units replace the conventional university lecturer. This is one of the huge advantages of distance learning mode; you can read and work through specially designed study materials at your own pace and at a time and place that suit you best.

Each of the study units follows a common format. The first item is an introduction to the subject matter of the unit and how a particular unit is integrated with the other units and the course as a whole. Next to this is a set of learning objectives. These learning objectives are meant to guide your studies. The moment a unit is finished, you must go back and check whether you have achieved the objectives. If this is made a habit, then you will significantly improve your chances of passing the course.

Self-assessment exercises are provided throughout the unit. Working through these exercises will help you to achieve the objectives of the unit and also prepare you for tutor marked-assignments and examination. You should attempt each exercises as you encounter them in the units.

TUTORS AND TUTORIALS

There are 16 hours of tutorial provided in support of this course. You will be notified of the dates, time and location together with the name and phone number of your tutor as soon as you are allocated a tutorial group.

Do not hesitate to contact your tutor by telephone, e-mail or via the discussion board if you need help. The following might be circumstances in which you would find help necessary.

Contact your tutor if:

- You do not understand any part of the study units
- You have difficulty with the assignments/exercises
- You have questions or problems with your tutor’s comments on an assignment or with the grading of an assignment.

You should try your best to attend the tutorials. This is the only chance to have face to face contact with your tutor and ask questions. You can raise any problem encountered in the course of your study. To gain the maximum benefit from the course tutorials, prepare a list of questions before hand, you will learn a lot from participating actively in the discussions.

GOODLUCK!

MAIN COURSE

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MODULE 1 OVERVIEW OF DENTAL TECHNOLOGY

UNIT 1 DEFINITION AND SCOPE OF DENTAL TECHNOLOGY

CONTENTS

1.0 INTRODUCTION

In this unit, you will be introduced to a profession whose duties are to undertake the tasks of design and construction of different dental, oro-facial and craniofacial appliances. These appliances are designed and constructed for the replacement and or correction of teeth and their associated structures in the oral cavity as well as facial and cranium regions for use by patients. In doing this, certain principles, procedures and materials are involved which must be followed strictly to achieve the desired objectives.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- describe dental technology
- explain the role of dental technologists in health care delivery
- discuss the modus operandi in dental technology.

3.0 MAIN CONTENT

3.1 What is Dental Technology?

Dental technology is a branch of dentistry which deals with the art and science of design, construction and servicing of dental, oro-facial and craniofacial appliances for the replacement and correction of missing part(s) or mal-placed part(s) of human body according to prescription.

This missing or mal-placed part(s) can be as a result of accident, disease or congenital in nature.

Dental technology as a profession or field of study is vast and is subdivided into four (4) different but interrelated units, viz. Prosthodontic technology, orthodontic technology, conservative technology (crown and bridges) and maxillofacial technology.

3.1.1 History of Dental Technology in Nigeria

Nigeria does not really have recorded events on orthodox dental practice as in Europe, Asia and America. However, history of dentistry and oral rehabilitation, teeth replacement, in Nigeria has its origin traced to the Agatu tribe in Benue State of who used bones and wires to replace teeth. As it were, the recorded event about dental technology in Nigeria followed the end of Second World War in 1946 when one Mr. S. E..Baker (British citizen) was deployed to the Royal Army Dental Corps Unit in Lagos. In 1953, the Western Regional Production Development Board Ibadan advertised to send people on course which attracted many applicants. When the selection and interview was completed in March 1954, five candidates emerged successfully to study dental technology. These candidates were Mr. Akadri (who retired as a Lt. Col in the Nigerian Army), Mr. Adetunji, Mr. Akila, Mr. Anokwu and Mrs. Ashogbon.

Unfortunately, their deployment for study in suitable institution was futile in 1954.

However, the dental mechanic instructor at Broad Street Lagos Mr. S.E Baker was contacted privately to assist in coaching these students. This was almost towards the end of 1955.

Through his advice and assistance instead of training privately in Lagos, arrangement was made on how these five students will travel to United Kingdom to study dental mechanics. This arrangement was concluded by October 1955 and by November 1955 they finally departed to Britain for the programme.

It was at Rutherford College of Technology in Britain that they were admitted for their course of study and be involved for practical work, under Mr. H Feartherstone's dental laboratory in Newcastle Upon-Tyne. At Newcastle, it was discovered that two years earlier, some students from other parts of Nigeria have written their City and Guild intermediate. These students and one Mr. G. Otigba were very instrumental to those boys admission. Pa Eldred Efiok Eyo a Federal Government candidate was also very helpful to them and other students from Ghana and Liberia.

Pa Eyo is an indelible name in the history of dental technology to the extent that he became the first Nigerian Dental Technologist and later the first indigenous chief instructor at the Federal School of Dental Technology at No.1 Broad Street Lagos.

Change of Designation

At Rutherford College, efforts were made to change the designation through Mr. H. Feartherstone from dental mechanics to dental technology. Although, this was approved but not effected to the dismay of the students when they came back to Nigeria in 1960.

Change in Salary Scale

The salary grade known as CT 2, 3, 4 for technologist graduates was a struggle by those students while in United Kingdom. The Regional government in Nigeria granted this. Along the line the cancellation of 50% commission to surgeons and "dash" given by surgeons to technologists was also fought for and later this was cancelled. As at now, the grade level of fresh graduate of dental technology in the civil service scale is level 08.

Establishment of Training Institutions in Nigeria

In 1955, the first training institute for dental technology was established; this was at No. 1 Broad street Lagos.

This school was later moved to Trans-Ekulu, Enugu in 1982 and designated Federal School of Dental Technology and Therapy. About 400 Nigerians, two Senegalese, five Gambian and 15 Ghanaians have graduated as dental technologist from the school as at 1993. The school was accredited as City and Guild of London examination centre in 1983 and later for the award of Higher National Diploma (HND) by the National Board for Technical Education (NBTE). It was also recorded that in 1970, the Armed forces established an institution at Military Hospital, Yaba Lagos. The Army institution was later moved to their

permanent site at Nigerian Army cantonment, Ojo Lagos in 1977. It is equally important to note that between 1961 and 1964, the expatriates heading the Institution at Broad Street were replaced by Nigerians who had trained in the United Kingdom.

Furthermore, the profession of dental technology witnessed a new dawn of advancement with the Federal University of Technology, Owerri, Imo State, establishing the Department of Dental Technology in 2003 for the award of Bachelor of Technology (B.Tech) degree in dental technology with Mr. Ken Okeke as the pioneer staff.

The Association of Dental Technologists of Nigeria (ADTN)

The increase in awareness of the services of the dental technology after the return of the first Nigerian Dental technologist who trained abroad and the necessity for a common fight for the right and benefits of the professionals in the health sector both at federal and state levels prompted the formation of ADTN.

The Association was as a result of like minds in the profession having the need for pursuits of the goals and objectives of the profession as common body and also protection of the interest of the profession.

Though in existence, the Association did not have any secretariat until 1976 when for logistic reasons a mini secretariat was carved out at the School of Dental Science, College of Medicine, Lagos University Teaching Hospital (CMUL/LUTH) Idi-araba. As it were, these gentle men and ladies started making more positive impacts in the health sector and even to the government bodies as the need and importance of dental technology arose in the society. With their individual and collective efforts with meager resources available, they pressurised to various tribunals and commissions for signing the profession into law for full government recognition. This effort was a great success as it gave birth to the Dental Technologists Registration Board of Nigeria (DTRBN). The motto: "For Beauty and Function."

3.2 Mode of Operations/Functions in Dental Technology

In carrying out the functions of design, construction and servicing of appliance, the dental technologist most times do not perform these functions directly on the patients but depends on physical positive reproductions of the areas to be worked on (models).

In order to carry out these functions properly, a sound knowledge of anatomy, physiology and pathology as well as materials science is very essential as there is a close link between them. This sound knowledge

together with technological skills are also necessary and these can be achieved by the acquisition of in-depth technological expertise and practical skills.

3.3 Aims of Dental Technology

This programme, dental technology, aims at:

- gaining readily applicable knowledge regarding anatomical principles, detailed knowledge of the physiological and pathological effect of the materials used for appliances and prostheses in order to achieve masticatory and phonetic efficiency; aesthetic principles of oral, oro-facial and craniofacial rehabilitation.
- acquiring practical knowledge about the interdependency of the forms and tissues, organs and organs systems.
- working out criteria and construction conditions for producing functional appliances and prostheses.

4.0 CONCLUSION

In this unit, we have learnt the scope of dental technology with focus on what dental technology is history of dental technology in Nigeria, mode of function or operation in dental technology services as well as the aim of undertaking the course of dental technology as a programme.

5.0 SUMMARY

In this unit, you have dealt with the meaning of dental technology as the art and science of producing dental, oro-facial and craniofacial appliances for patients use. You have also learnt of the various interrelated courses which are essential for the production of aesthetically functional appliance while depending on the physical positive reproduction of the aspect of human body to be worked on. You have also learnt of the aim of dental technology which is to gain the knowledge of anatomy and physiology as well as pathological effect of materials used on human body; acquire understanding of interdependence of factors and work out criteria for production of aesthetically functional appliances and prostheses for patients use.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is dental technology?
2. List the various branches of dental technology.
3. What are the essential and interrelated courses necessary for the production of aesthetically functional appliances?

7.0 REFERENCES/FURTHER READING

Arnold-Hohmann & Werner Hielscher (2001) Introduction to Dental Technology. (Translated 2003) In *Quintessence Journal of Dental Technology* (QJDT) 1, 1, pp. 75-85.

Klaus Dittmar (2004). A Systematic Approach to Partial Denture Fabrication. *Dental Dialogue,* Vol. 4-1 pp. 39-46.

UNIT 2 PROSTHODONTIC TECHNOLOGY

CONTENTS

1.0 INTRODUCTION

In the last unit, you learnt about the overview and scope of the dental technology which is now leading us into this very aspect of dental technology. This unit deals with appliances which are designed and constructed to replace missing teeth and parts of alveolar tissue for both entire teeth in the mouth (edentulous) and for situation where not all the teeth in the mouth are missing (partial).

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the classification of appliances in prosthodontic technology
- list the components of prosthodontic appliances

- explain the functions of prosthodontic appliances
- discuss the maintenance and care for prosthodontic appliances.

3.0 MAIN CONTENT

3.1 Definition of Prosthodontic Technology

Prosthodontic technology is the branch of dental technology which deals with the replacement of tissues (teeth, parts of the alveolar ridge and mucous membrane) using removable appliances such as partial denture for partial or dentate and full or complete dentures for edentulous cases; the aim being to integrate both the form being replaced and the restoration of functions. In other words, prosthodontic appliances should replace not only tissues but also functions in the same way as the natural tissues without undue interference.

3.2 Functions of Prosthodontic Appliances

Having understood what prosthodontic appliances are, we shall go further to look at their functions. It is a known fact already that natural tissues undertake certain important functions in the oral cavity, therefore their replacement ought to function and serve the same purposes the natural teeth undertake. These functions which include but not limited to the following understated are;

- Aesthetics and phonetics, incising, holding, grasping and tearing –anterior teeth
- Masticatory efficiency and aesthetics- posterior teeth
- Preservation of health of oral tissues and structures
- Prevention of over eruption of opposing teeth
- Prevention of drifting of adjacent teeth, splinting
- Preservation of vertical dimension.

3.2.1 Aesthetics and Phonetics, Incising, Holding, Grasping and Tearing

These functions are performed by the natural anterior teeth and as such their artificial substitutes ought to do and serve same purposes. Natural anterior teeth support the profile of the lips and the face thereby “imparting the personality of individuals.” They are very important in aesthetics as they form the corners of the mouth. These anterior teeth also play very important role in phonetics (speech). People without anterior teeth or having anterior teeth missing without replacement find it difficult to pronounce certain sounds of alphabets such as F, S, V, T etc.

Prosthodontic appliances therefore restore these functions which would have otherwise been an embarrassment and psychological trauma to patients. Incising, holding, grasping and tearing of edibles are all functions of natural anterior dentition. In the absence of the natural dentition, prosthodontic appliances undertake these functions effectively.

3.2.2 Masticatory Efficiency and Aesthetics (when they carry Posterior Teeth)

Loss of posterior teeth carries with it impairment in mastication and change in dietary conditions but with prosthodontic appliance being in place, such impairment and dietary change are eliminated as such patient will continue with his/her dietary pattern without interference. Loss of teeth is associated with collapse of the cheek and lips muscles thereby altering the facial structure and outlook of such patient but with artificial substitute such alteration is eliminated.

3.2.3 Preservation of Health of Oral Tissues and Structures

Loss of natural dentition leads to rapid resorption of alveolar bone and change in the shape of tongue but prosthodontic appliances help in preservation of oral tissues by actions such as maintenance of vertical dimension which helps in ensuring that the vertical distance between the jaws are maintained, thus preventing the development of angular chelitis, cheek biting etc.

3.2.4 Prevention of Over Eruption of Opposing Teeth

The relationship between opposing teeth helps in ensuring maintenance of vertical height of the various teeth in the mouth. The absence of tooth/teeth on a particular jaw leads to the opposing tooth/teeth growing higher than other teeth of that jaw thereby causing occlusal derangement or aesthetics disfigurement. The replacement of such missing tooth/teeth with prosthodontic appliance therefore, helps in the prevention of this overgrowth by opposing tooth/teeth.

3.2.5 Prevention of Drifting/Tilting of Adjacent Teeth

Absence of tooth/teeth on a particular jaw leads to the movement of the standing adjacent teeth so as to cover the space created by such loss. Prosthodontic appliances thus serve as space maintainer, preventing such drifting, tilting or rotation of natural standing teeth.

3.2.6 Preservation of Vertical Dimension

The vertical distance between the jaws are maintained by the presence of teeth on both jaws. Loss of teeth, especially edentulous cases leads to alteration of such vertical distance by the over closure of the jaws which ultimately causes temporo-mandibular joint dysfunction, soreness of the angles of the mouth and other pathological effects but with prosthesis in place, such alteration is prevented with its attendant consequences.

3.3 Maintenance and Care for Prosthodontic Appliances

Subsequent upon insertion or fitting of prosthodontic appliances, patients are advised and instructed on the handling and care for such appliances. Prosthodontic appliances are to be in the oral cavity at all times, except when cleaning, which must be done regularly with soap solution, if desired. Regular cleaning ensures that food particles/debris is not allowed to stay on the surfaces of the appliance, thereby preventing mal-odour and other pathology. Appliance should always be in water at room temperature whenever it is not in use (mouth) to avoid drying out and subsequent ill-fitting of the appliance. It must be handled with care when in use or out of use to prevent fracture or breakage. When in use, the patient must be conscious of it and avoid its use in cracking of hard nuts, bones etc as traumatic bites have negative consequences. When out of the mouth, during cleaning or other procedures, it must be handled with care and not impacted upon by heavy object or forcefully to prevent cracking, fractures or deformation of such appliance.

3.4 Classification of Prosthodontic Appliances

Prosthodontic appliances are classified based on their area of coverage and the component parts making up the appliance. They are either complete or partial appliance.

3.4.1 Complete Prosthodontic Appliance (otherwise called Complete or Full Denture)

This is that which replaces the entire teeth in the jaw and their associated parts. It is used for the treatment of edentulous case(s) where no standing natural tooth is in the jaw.

3.4.1.1 Component Parts of Complete Denture

The following are the components parts of complete denture:

The base, flange, teeth and denture border.

3.4.2 Partial Prosthodontic Appliance (otherwise termed Partial Denture)

This is that which replaces one or two (or more group of teeth) but not all natural teeth and their associated parts in the jaw. It is used for treatment of cases which has at least one standing natural tooth.

3.4.2.1 Component Parts of a Partial Denture

The following are the components parts of a partial denture:

Saddle or denture base, connectors (major and minor), abutment(s), rests and similar components, retainers-direct and indirect, tags and artificial teeth.

4.0 CONCLUSION

In this unit, you have learnt about prosthodontic technology with focus on functions, classification, maintenance and care for such appliances as well as component parts of prosthodontic appliances.

5.0 SUMMARY

At the end of this unit, you have learnt the meaning of prosthodontic technology as that branch of dental technology which deals with the replacement of oral tissues using removable appliances. You have also learnt of the basic and remote functions of these prosthodontic appliances as well as their classification and component parts making up the appliances. You have also learnt and can now advice a patient on the best ways to care for and maintain his/her prosthodontic appliance. In the next unit, we shall be going into another aspect of dental technology which is maxillofacial technology.

6.0 TUTOR-MARKED ASSIGNMENT

1. Briefly discuss the concept of prosthodontic technology.
2. What are the reasons for the construction of prosthodontic appliances?
3. Why do you have to care and handle prosthodontic appliance with utmost care.

7.0 REFERENCES/FURTHER READING

Grant, A. A. & Wesley Johnson (1992). *Removable Denture Prosthodontic.* (2nd ed.). Edinburgh: Churchill Livingstone.

Henderson, D. & Steffle, V. I. (1969). *McCracken's Partial Denture Construction: Principles and Techniques*. St. Louis: The CV Mosby Company. pp. 18-19.

Osborne, J. & Wilson, H. J. (1970). *Dental Mechanics for Students* (6th ed.). London: Staple Press.

John Farrel (1971). *Partial Denture Designing.* (2nd ed.). London: Henry Kimpton Publishers.

UNIT 3 MAXILLOFACIAL TECHNOLOGY

CONTENTS

1.0 INTRODUCTION

In this unit, we shall look at the aspect of dental technology which deals with the fabrication of oral, maxillofacial and crani-facial prostheses.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define maxillofacial technology
- itemise the basic requirements for the production of functional maxillofacial prostheses
- state the conditions that can permit use of maxillofacial prostheses

3.0 MAIN CONTENT

3.1 Definition of Maxillofacial Technology

Maxillofacial technology is a branch or specialty of dental technology which deals with the application of thermoplastic and synthetic materials for the rehabilitation of facial defects. It involves the science and skill to replace and rehabilitate these defects where surgical reconstruction is not feasible or contra-indicated. These defects and deformities are acquired through deadly diseases like cancer, traumatic injuries and deformities arising from congenital malfunction such as cleft palate etc.

3.2 Aims of Maxillofacial Technology

Maxillofacial technology like every aspect of dental technology aims to design and construct prostheses that are worn by patients to provide them with the necessary comfort, convenience and function as the natural structure and or tissue(s) which such prostheses replace.

3.3 Ideal Requirements of Maxillofacial Prostheses

The following are the ideal requirements of maxillofacial prostheses:

- All maxillofacial prostheses should, as a matter of necessity, serve the purpose of natural structure, organ or tissue they replace.
- They must not interfere with the natural tissues and structures.
- They must be made of bio compatible materials which must not be allergic to the soft and hard tissues of the body.
- They must also be absolutely free from any kind of carcinogenic potentials as well as adverse immunological response.
- They should help preserve the heath of the surrounding tissues where they are fitted or placed.

3.4 Indications and Contraindications for Maxillofacial Prostheses

3.4.1 Indications

Maxillofacial prostheses are indicated for where surgical reconstruction is not feasible or where the likelihood of cosmetically acceptable result is promising. Some conditions that present for maxillofacial prostheses are:

i. Where the local condition of tissue may be such that if surgical procedure is undertaken, the disease may likely re occur thereby making the entire procedure an exercise in futility.
ii. Where loss of tissue is extensive that skin/tissue grafting may not be feasible.
iii. Where the anatomical region to be reconstructed requires exact precision of contours that such surgical procedure may not be permitted.
iv. Age of patient, advanced, may not permit series of surgery required.
v. Where the tissue is being preserved by treatment with radioactive rays (irradiation), such surgical reconstruction exposes the patient to high risk.

vi. Where the patient may not be able to afford the time and cost of surgical procedures.

3.4.2 Contraindications

Where any of the above six conditions (indications) does not arise, surgical reconstruction will be considered as against prosthetic appliance.

4.0 CONCLUSION

In this unit, you have learnt the definition maxillofacial technology. You have also learnt the aim of maxillofacial technology and prostheses which have to do with the ability of prostheses to serve the same purpose the natural tissues and structures serve. You also learnt the ideal requirements of maxillofacial prostheses as well as the indications and contraindications for maxillofacial prostheses.

5.0 SUMMARY

In this unit, you have learnt the meaning of maxillofacial technology as the branch of dental technology which deals with the use of synthetic and thermoplastic materials for construction of prostheses for the rehabilitation of maxillofacial, craniofacial defects.

You have also learnt about the aim of maxillofacial technology and prostheses which is to serve the purposes or functions of the natural tissues and structures which they replace. You have learnt, also the ideal requirements of maxillofacial prostheses which have to do with compatibility, non allergic/toxic to the soft tissues with which they have contact with while preserving same.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define maxillofacial technology.
2. What is the basic aim of maxillofacial technology?
3. Mention three (3) ideal requirements of maxillofacial prostheses.

7.0 REFERENCE/FURTHER READING

Arthur H. Bulbulian (1973). *Facial Prosthetics*. Springfield, Illinois: Charles C. Thomas.

UNIT 4 ORTHODONTIC TECHNOLOGY

CONTENTS

1.0 INTRODUCTION

In this unit we shall look at the general introduction to orthodontic technology which is one of the basic aspects making up the profession and programme of dental technology. This unit will dwell on the basics as it relates to orthodontic technology bearing in mind that detailed discussion on the topic will take a centre stage at a later part of the programme.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the meaning of orthodontics and orthodontic technology
- explain etiology and developmental changes that lead to orthodontic problems (epidemiology of malocclusion)
- state the need and conditions that will warrant the use of orthodontic appliance
- classify orthodontic treatment/appliances.

3.0 MAIN CONTENT

3.1 What is Orthodontics and Orthodontic Technology?

"Orthodontics is the area of dentistry which deals with the supervision, guidance and correction of the growing and mature dentofacial structures, including those conditions that require movement of teeth or

correction of malrelationships and malformations of related structures by the adjustment of relationships between and among teeth and facial bones by the application of forces and/or the stimulation and redirection of the functional forces within the craniofacial complex".

The above definition encompasses the totality of orthodontic while orthodontic technology is the aspect of dental technology which deals with the design and construction of appliances for the correction of malposed or malplaced dentition. This is done by either retracting, protracting or side movement of tooth/teeth to their correct position and relationship with the adjacent or opposing teeth within the limit set by biological factors.

These appliances are either active or passive. The *active ones* are those that posses springs, screws or elastics to supply force by which the expected action is carried out, while the *passive ones* in themselves are completely inactive and do not posses or supply force but are the means through which forces originating from musculature are transmitted to the teeth.

3.2 Why do Patients Need Orthodontic Treatment?

Patients need orthodontic treatment due to three (3) basic reasons. These are; (i) Psychosocial reasons (ii) Oral function (iii) Predisposition to oral/periodontal diseases or tooth decay.

3.2.1 Psychosocial Reasons

Living with an orthodontic case such as crowding, protruding or maloccluded or recess dentition can be a source of unhappiness and perceived disfigurement of the face. The usual jeers associated with malpositioned dentition, most times, bring about negative status. It is a known fact that appearance can make a difference. A well aligned teeth and a pleasing smile carry positive status at social events or gathering, whereas irregular, protruding or crooked teeth carry negative status. For example, the appearance of a teacher before his/her students with crooked teeth has the potential of producing an unpredictable responses from his/her students and therefore, capable of producing anxiety and can have strong negative effects on such students.

3.2.2 Oral Function

Deep or severe malocclusion may compromise all aspects of oral function. This may cause some difficulty in mastication and production of certain sound during speech. Difficulty in mastication can lead to adaptive bite or bite of convenience thereby producing

Temporomandibular (TMJ) syndrome, manifested as pain in and around the TMJ. It is also known that certain level of occlusion imperfection can trigger involuntary clenching and grinding activities of the jaws. It therefore follows that imperfection in occlusion ought to be rectified to avoid the possibility of developing facial muscle pain associated with clenching and grinding.

3.2.3 Predisposition to Oral/Periodontal Diseases

Though it has been argued that malocclusion does not play a primary role in influencing tooth decay, occlusal is known to play secondary role. This can be seen from the packets formed as a result of the imperfect occlusal relationship which, most times, make cleaning of such spots extremely difficult thereby making the area susceptible to periodontal disease.

3.3 Etiology and Development of Orthodontic Problems

Malocclusion and associated deformities of the dentofacial regions arise from distortions of normal development. These can be as a result of some environment reasons or genetics factors.

3.3.1 Environmental Factors

Life pattern of a particular society influences the condition of their occlusal and dentofacial conditions. Certain ailments such as cardiovascular diseases-High Blood Pressure, heart disease, diabetes etc have been attributed to the change of life pattern of some society from Agrarian to city/civilisation life pattern. Dental cases including malocclusion are often classified into this category. Evidence abound that malocclusion increases in some well defined populations after their transformation from rural or city populace.

3.3.2 Genetic Factors

a) Disturbances during embryologic development

During the development of the embryo, certain disturbances do occur and this ranges from certain drugs or chemical substances or agents which are taken during pregnancy. These are termed “teratogens” and they are known to produce orthodontic problems. These are:

i. Disturbances of dental development

Disturbances of dental development may lead to certain congenital defects such as:

Class 1 malocclusion:

- anodontia -total absence of teeth
- oligodontia-congenital absence of many teeth but not all
- hypodontia-absence of only a few teeth.

Anodontia and oligodontia are associated with mild systemic abnormality called *ectodermal dysplasia.*

ii. Malformed and super-numeral teeth

The most common of this is the variation in size especially the maxillary lateral incisors and second premolars. Occasionally, there may be a fusion of tooth buds or germination (Partial Split) resulting in a tooth with separate pulp chambers but joining of dentin. Normal occlusion therefore becomes impossible with either of the conditions. Supernumerary or extra teeth results in disturbances of dental developmental stage with the most common appearing in the maxillary midline – Mesiodens.

Lateral incisors, extra premolars as well as fourth molars appear occasionally.

The presence of super-numeral teeth obviously does have the ability to disrupt normal occlusal development.

iii. Interference with eruption

The presence of Cleidocranial dysplasia which causes the presence of super-numeral teeth gives room for interference with eruption. This interference makes the teeth to drift to an improper position.

iv. Ectopic eruption

This is the eruption of teeth in the wrong place/position due to malposition of teeth. If the maxillary first molar erupts too mesially at early stage, it disrupts the eruption of the permanent molar and damages the root of second primary molar (milk teeth). This mesial position of the permanent molar means crowding of the arch thereby necessitating orthodontic intervention.

v. Improper guidance of eruption

When early loss of primary teeth occurs, the arch tends to contract and the space closes. This closure of space causes crowding and mal-alignment within dental arches.

vi. Functional shift of the mandible

During the period of eruption of permanent teeth, usually both transverse and anteroposterior deviation in tooth position occur. This deviation as it relates to occlusal relationship or interferences can lead to development of both posterior and anterior cross bites.

There are several other causes of orthodontic problems beyond this text and are therefore left for the contemporary surgical text.

3.4 Classification of Malocclusion

Malocclusion is the deviation from the normal occlusion. Edward H Angle Postulates that maxillary first molar 6/6 were the key to occlusion and that the maxillary and mandibular molars should relate so that the mesiobuccal cusp of the maxillary molars occludes in the buccal groove of the mandibular molar. He posits that if this occurs, the teeth will be arranged on a smoothly curving line of occlusion.

Angle therefore described three classes of malocclusion based on the occlusal relationship of the first molar as the following:

Class 1 malocclusion

Normal relationship of the molar, but line of occlusion incorrect because of malposed teeth, rotations or other causes.

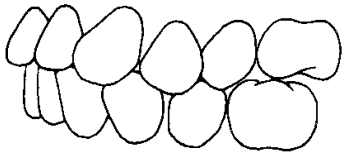

Fig.4.1: Class I malocclusion

Class II malocclusion

Lower molar distally positioned relative to upper molar, line of occlusion not specified.

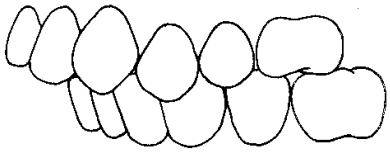

Fig. 4.2: Class II malocclusion

Class III malocclusion

Lower molar mesially positioned relative to upper molar, line of occlusion not specified.

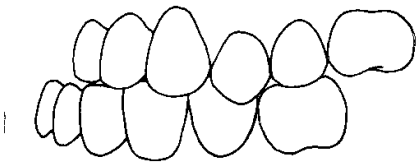

Fig. 4.3: Class III malocclusion

3.5 Classification of Orthodontic Appliances

Orthodontic appliances are classified into two broad categories namely active and passive appliances.

3.5.1 Active Appliances

These are appliances designed and constructed which posses or carry springs, screws or elastics to supply pressure or force by which the expected actions is carried out. They are usually worn and adjusted with time as the expected adjustment, action or movement of the structure as required takes place. The pressure or force exerted by spring is determined by such factors as: materials used, cross sectional shape, thickness and length of such material. Examples are protraction and retraction arch appliances.

3.5.2 Passive Appliances

These are appliances which in themselves are completely inactive and do not posses or supply forces but are means through which forces originating from musculature are transmitted to the teeth. The amount of pressure or activation by passive appliances is determined by the thickness of the appliances and the musculature development of the patient, e.g. oral screen which is passive yet capable of transmitting pressure exerted by the muscles of the check and lips.

3.6 Indications for Orthodontic Appliances

The ultimate goal of orthodontics appliances is to create or maintain a state in which the long axis of permanent dentition is virtually parallel to allow uninterrupted eruption of permanent dentition between them.

Laboratory designed and constructed orthodontic appliances are indicated for:

- hen limited tooth/teeth movement are required especially for arch expansion or correction of individual tooth malposition
- Growth modification during the transition or mixed dentition period
- Retention or stabilisation of dentition after comprehensive treatment has been undertaken.

Laboratory constructed orthodontic appliances are contra indicated when there is need to:

- move a tooth beyond certain limit such as 3mm
- move the root of teeth
- undertake comprehensive orthodontic treatment.

4.0 CONCLUSION

In this unit, you learnt the meaning of orthodontic technology, the prompting of the need for orthodontic treatment as well as the etiology and developmental changes in humans that lead to orthodontic cases. You also learnt the various classes of orthodontic cases/malocclusion as well as the classes of orthodontic appliances. The various conditions that will permit the use of laboratory constructed orthodontic appliances have also been discussed.

5.0 SUMMARY

In treating this unit, you have learnt what is meant by orthodontic technology which is a branch of dental technology which deals with the design and construction of appliances for the correction of malposed or malplaced dentition. You have also learnt the three reasons why patients need orthodontic treatment which are (i) psychosocial reasons (ii) oral function and (iii) predisposition to oral/periodontal diseases or tooth decay. Also in the course of this unit, you have learnt the etiology and development of orthodontic problems which are either environmental or genetic. The classification of malocclusion in line with Edward H Angles' Postulations has also been treated viz. class 1, class II, and class III malocclusions. Classification of orthodontic appliances into active and passive has been treated also. Conditions, under which laboratory constructed orthodontic appliances are to be made, have been dealt with as well.

6.0 TUTOR-MARKED ASSIGNMENT

1. Discuss Angle's classification of malocclusion.
2. Differentiate between orthodontics and orthodontic technology.
3. Give the reasons why orthodontic treatments are needed by patients?

7.0 REFERENCES/FURTHER READING

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UNIT 5 CONSERVATIVE DENTAL TECHNOLOGY

CONTENTS

1.0 INTRODUCTION

In this unit, we shall be looking at another branch of dental technology, conservative dental technology. We shall study the basics of the topic as it relates to the definition and the extent of coverage. This section will also dwell on the conditions under which conservative appliances are to be provided or not considered for patients. We shall also look at what makes up conservative dental technology, their various classifications and ideal requirements for each component.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the meaning of conservative technology
- list factors or conditions that permit the construction of conservative dental appliance
- list and classify the various parts making up conservative dental technology
- explain the requirements to be fulfilled by an average conservative dental appliance.

3.0 MAIN CONTENT

3.1 Definition and Scope of Conservative Dental Technology

This is a branch of dental technology which deals with the design and construction of dental appliances which restore or replace missing, attrited, broken, discoloured or improperly developed tooth/teeth using fixed appliances which are cemented or attached on the teeth or adjacent tooth or teeth to effect support and stability. They are fixed and cannot be removed by the patient. In undertaking this aspect of dental technology, most times, the natural standing teeth/tooth are/is prepared, clinically, and the prosthesis/appliance designed, constructed and fixed on them for support. These appliances are made in acrylic resin, porcelain or metal, or a combination of metal and non-metal. They may be made to cover part(s) or the entire tooth surfaces. They comprise of different types of appliances viz. crowns, bridges, inlays and onlays.

3.2 Indications and Contraindications for Conservative Dental Appliances

3.2.1 Indications for Conservative Appliances

These are conditions under which conservative appliances are permissible or preferred.

- Excessively resorped alveolar ridge which makes retention and stability of partial denture impossible.
- Where the space or the number of teeth to be replaced is short or very few teeth.
- The adjacent tooth/teeth to the space being replaced is/are healthy enough to support the appliance.
- Where the patient may not be able to undertake proper handling associated with partial dentures.
- Where the patient prefers or insists on this even when the prevailing conditions show otherwise.

3.2.2 Contraindications for Conservation Appliances

These are conditions under which the use of conservative appliance as means of treatment is not permissible or allowed.

- Where the adjacent tooth/teeth to support the appliance is/are not healthy enough to withstand the stress that it is meant to bear.
- Very long space or too many teeth being replaced.
- Teeth that have very large pulp chambers.

- Tooth or teeth that is/are not properly developed thereby not allowing adequate support base for the appliance.
- Excessive amount of bone loss from the alveolar.
- Patients that are medically compromised such as hypertensive patients etc.
- Sensitive patients that are scared of treatments which involve invasive procedures.
- Spaces or span to be replaced on both sides of the jaw which will require stabilisation through joining / making them to one piece.
- Spaces or span to be replaced being on the extremities of the jaw which will make it impossible for the appliance to be adequately supported on both sides/ends.

3.3 Components of Conservative Dental Technology

These are the various aspects making up this branch of dental technology. They comprised of the following:

3.3.1 Crowns

Crowns are appliances designed and constructed which are used for the restoration of the appearances and masticatory efficiency of the tooth/teeth which has its crown aspect not properly developed, lost due to attrition, accident or disease; or used as a retainer in a bridge.
Crowns may be made of acrylic resin, porcelain or metal; or a combination of metal and non-metal.

3.3.1.1 Types of Crown and Indications

Various types of crown exist which range from those which cover part(s) to those which cover the entire tooth surfaces. Examples are: Jacket crown, full veneer or full all metal crown, partial veneer or three quarter (3/4) crown, post or post retained crown.

a. Jacket crowns

These are used on anterior teeth and are made of either acrylic resin or porcelain. Jacket crowns made of acrylic resin are temporal in nature though they posses good aesthetic properties, they are not durable due to their reduced strength and ease of discolouration. Jacket crown made of porcelain posses better permanency due to its colour stability and better strength. Jacket crowns are indicated for anteriors.

b. Full veneer or full all metal crowns

These are all cast appliance usually constructed for posterior teeth from which a layer of all the tooth/teeth surfaces has been removed. There might be some level of variation when it involves first bicuspid which for aesthetic reasons the buccal aspect of the metal is replaced by acrylic or porcelain. They are also used as retainers for bridges or as abutment for a removable partial denture. They are indicated for posterior teeth/restoration.

c. Partial Veneer or three quarter (3/4) crown

This is sometimes referred to as Carmichael crown. It is designed to restore all aspects of tooth surfaces (anteriors and posterior) except the labial and buccal aspects. It is used extensively as bridge retainer due to its strength and stability. This is indicated for anterior and premolars.

d. Post retained crown

This type of crown is designed and constructed for tooth/teeth in which so much of its structures, crown and pulp, have been removed or when an already root filled tooth/teeth has/have discoloured. This type of crown involves the preparation of a metallic post section which is shaped so that the portion which carries the crown is made to look like a preparation for jacket crown. The crown can be made in either acrylic resin or porcelain depending on the choice made. This is indicated for anterior.

3.3.2 Bridges

Bridges are fixed prostheses/appliances designed and constructed to restore one or more missing tooth/teeth which are cemented to the adjacent natural tooth/teeth, roots or implants from which primary support and retention are obtained. They are fixed and are not removable except by deliberate action of professionals authorised to do so.

3.3.2.1 Parts of a Bridge

These are the various component parts making up a bridge. They are:

Abutment (s): The tooth/teeth, root(s) or implant upon which the appliance is fixed and from which support is obtained. Can be an ordinary abutment or pier in which case it has span or pontic on the sides, anteriorly and posteriorly.

Retainer: The part(s) which unite the abutment(s) with the suspended portion of the bridges (pontic). They maybe in the form of inlays, partial or full veneer crowns, or onlays. They are cemented to the abutment(s).

Pontic(s): The part of a bridge which replaces the lost natural tooth/teeth for which the bridge is constructed. It restores the function and usually occupies the space of the lost natural tooth/teeth.

Connector(s): That part(s) which link the pontic(s) and the retainer(s). May be rigid or non rigid. Maybe soldered joints, occlusal rests, palatal spurs or slotted attachments.

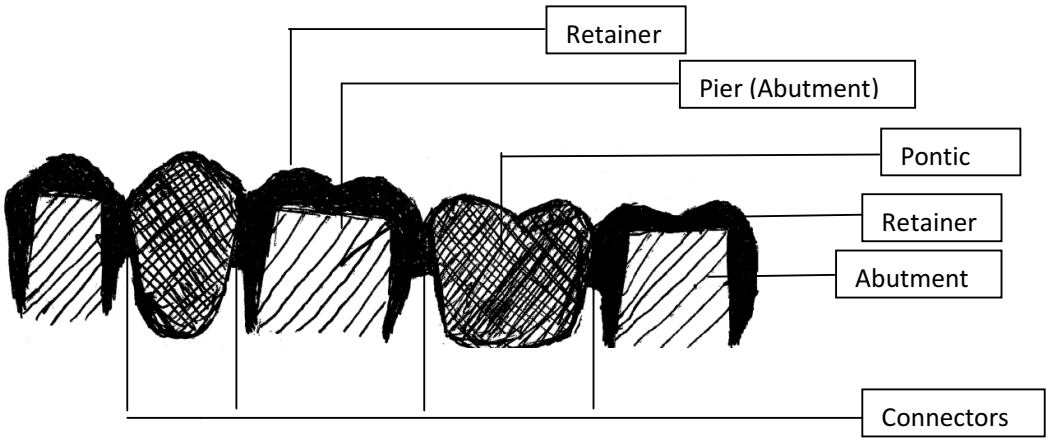

Fig 5.1: Parts of a Bridge

3.3.2.2 Classification of Bridges

Bridges are classified based on the way by which the appliances are connected to the abutment teeth. These are: Fixed-fixed, fixed-movable, cantilever, and spring cantilever.

Fixed-fixed bridge: This is the type of bridge where the pontic(s) are connected rigidly to the retainers at both ends of the bridges and hence there is rigid connection provided between the abutments.

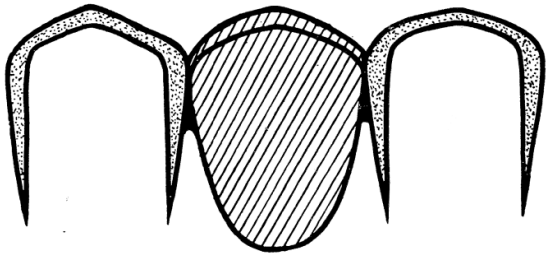

Fig. 5.2: Fixed-fixed Bridge
Source: Shaw F.G. & Scott D.C.

Fixed movable bridge: This is the type of bridge where the pontic is rigidly connected to one retainer but not to the other but posses an extension fitting into a receiving slot in the opposite retainer. This offers some limited movement between the pontic and the retainer. This is a non-rigid connector and the purpose is to facilitate its insertion and reduce stress on the abutment.

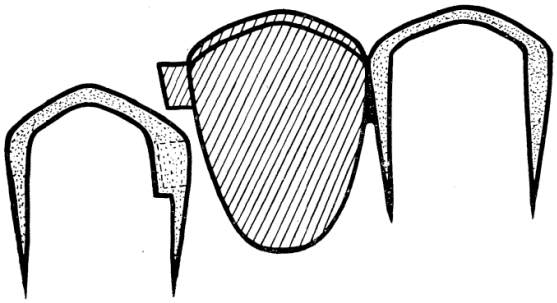

Fig. 5.3: Fixed-movable Bridge
Source: Shaw F.G & Scott D.C.

Cantilever: Also referred to as "plain cantilever" is the type of bridge which is rigidly connected to retainer at one end and completely unconnected or unsupported at the other end. In order to avoid much stress on the abutment, such retainers should be multiple; therefore the two retainers or more adjacent to each other are soldered or joined together.

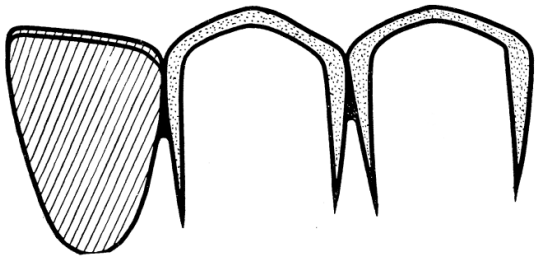

Fig. 5.4: Cantilever Bridge
Source: Shaw F.G & Scott D.C.

Spring cantilever bridge: This type of bridge is one in which the unsupported pontic is not adjacent to the retainer. The pontic is some distance away from the retainer and is connected by a narrow palatal bar. Most times, multiple retainers are used (soldered together) so as to minimise stress on the individual tooth and to ensure adequate strength.

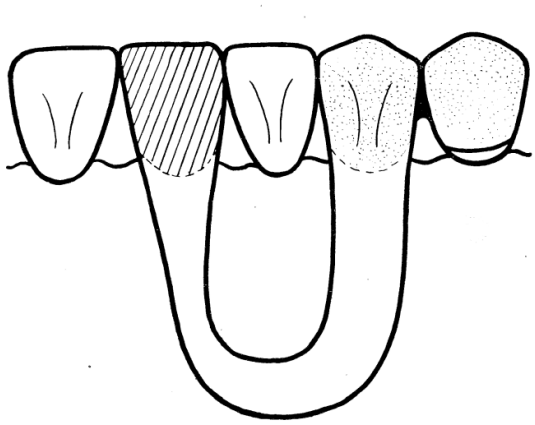

Fig. 5.5: Spring Cantilever Bridge

Source: Shaw F.G & Scott D.C.

3.3.2.3 Ideal Requirements of a Bridge

In every appliance for use in the oral cavity, there are basic qualities expected of such appliance to posses and bridges are not exempted from this. The ideal qualities expected of every bridge are:

a. The material(s) for its construction should be biocompatible and should not impinge on the tissues or produce any form of tissue reaction.
b. Should be comfortable to the patient.
c. Should preserve the underlying tissue, mucosa and alveolar bone. It should neither cause any ulceration to the mucosa nor cause resorption of the alveolar rigid
d. Good aesthetics
e. Should permit good oral hygiene. Should be easy to clean and maintain
f. Must possess adequate strength and perform the functions of the tooth/teeth it replaces. Incisal edge or cusps of pontics should be covered with metal to prevent wear of resin facing or chipping of porcelain
g. Bridges must never gag the bite
h. Must not permit adherence of food particles on its surface. Should be highly polished
i. Must be free from any form of cuspal interference.

4.0 CONCLUSION

In this unit, you learnt conservative dental technology which deals with the design and construction of dental appliances to restore missing, attritted, broken, discoloured or improperly developed dentition using

appliances. These appliances are attached or connected to adjacent natural tooth/teeth for support. We also looked at the materials, metals and non metals, used in the construction of the appliance. You have also learnt about the various indications and contraindications for conservative dental appliances. In the same vein, the components making up conservative dental technology viz. crowns and bridges have been dealt with, including their types or classification, indications and ideal requirements of the various components of conservative dental technology.

5.0 SUMMARY

In this unit, you learnt the meaning of conservative dental technology, factors or conditions that permit the construction of conservative dental appliances, the various components making up conservative dental technology as well as the classification of these component parts. The ideal expectations they are suppose to fulfill have also been learnt.

6.0 TUTOR-MARKED ASSIGNMENT

1. With the aid of a diagram describe the parts of a bridge.
2. Give five (5) conditions under which conservative dental appliance (bridge) is not permissible.
3. List the various types of crown known to you and describe in details two (2) of these types of crown.

7.0 REFERENCES/FURTHER READING

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MODULE 2 LAW OF FORM AND FUNCTION

UNIT 1 CHARACTERISTICS ARRANGEMENT OF TEETH

CONTENTS

1.0 INTRODUCTION

The first step in understanding the theory and practice of dental technology is the understanding of teeth and its associated structures. The teeth in function help to maintain and retain the health of the physiolic structures of the mouth and their functions viz. mastication, swallowing-deglutition, phonetics and breathing.

The formation of teeth and the development of the entire oral cavity and growth are all closely linked together. It is therefore very important to understand the various or individual tooth making up the dentition, their shapes and reasons for these shapes as well as the relationships between these teeth. The form each tooth assumes is directly proportional to its functions and any deviation from the form or shape brings about a corresponding deviation in the functions of the tooth and vice versa.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- identify the landmark and physiology of the denture bearing areas, and how they play their parts or roles in holding dental appliances in their correct position in the mouth
- explain the various landmarks making up individual tooth and the part they play in the functions of the dentition
- define the various terminologies associated with dentition and the relationship existing between the various teeth in the mouth.

3.0 MAIN CONTENT

3.1 The Denture Bearing Areas and Coverage

The mouth or oral cavity as we know it is lined up by mucous membrane which is attached to the teeth, the alveolar bone and the hard palate or floor of the mouth. The mucous membrane is also related to the soft tissues, the tongue, the cheek and lips. A situation where the mucous membrane is related to the bone, it is firm because the amount of membrane there is very thin and immovable and can be a support to the denture. Such areas are referred to as hard palate but while the areas where the mucous membrane is related to the muscles are usually soft, sensitive and movable and they are referred to as soft tissues. They do not take part in the support of denture. The area which bears the force or stress associated with the appliance is the upper and lower ridges. Their relative size and shape contribute to the suitability of this area in bearing denture appliance.

In upper jaw, it is known that dentures cover the entire palate and this palate bears part of the stress or force applied on the appliance. The palate is known to bear some prominent features such as rugae, palatal torus and tuberosities, and these prominent features bear nerves which supply blood to the area. It is therefore necessary that in the construction of denture, these prominent features are relieved adequately to ensure that well fitting denture do not press on them and interrupt blood supply as well as inflicting pain. In the lower jaw also prominent features such as retromolar pads are relieved. In upper denture construction, the entire palate, facial and buccal aspects of the ridge are covered, except in rare cases. In the lower, the entire ridge is covered, up to the retromolar pads. Adequate relief is given to all muscles of attachment.

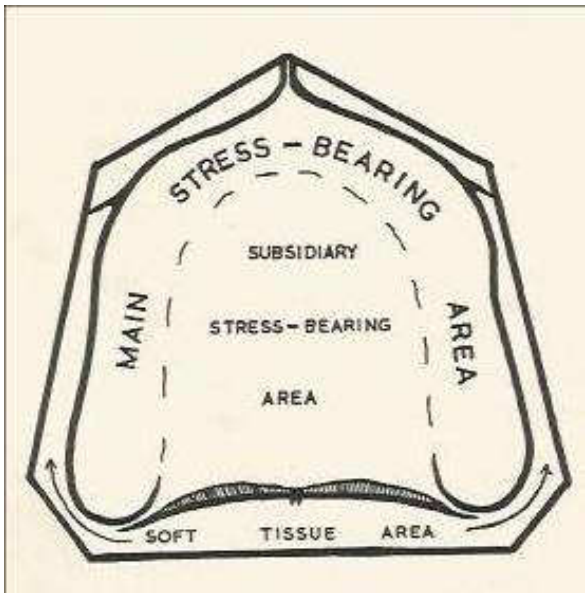

Fig. 1.1: Denture Bearing Area
Source: Shaw F.G & Scott D.C.

3.2 The Teeth and their Arrangement in the Mouth

The teeth are bony structures which are seen occupying the oral cavity and are composed of different types and shapes to make up the dentition. Each tooth is composed of different substances making it up. Each tooth has crown (the portion of the tooth seen in the mouth) and the root (the portion of the tooth which is below the gum) which is embedded in the alveolar bone. The crown is covered by the enamel while the root is covered with cementum. Both the crown and the root join at the cementoenamel junction; also referred to as cervical line. A cross section of the tooth displays four (4) basic tissues viz. Enamel, Dentine, Cementum and Pulp. The first three (3) being the hard tissues and the last is soft tissue.

Enamel: This is the calcified outer covering of a tooth crown. It is very hard and smooth and protects the dentine.

Dentine: The portion of a tooth that is covered by enamel and cementum. It is bony-like in nature and makes up the bulk of the tooth.

Cementum: The calcified tissue that covers the dentine at root region. Though calcified, it is more coarse and softer than the enamel.

Pulp: The connective tissue with nerve endings which fills the pulp chambers and root canals of a tooth. It consists of cells and fibres that furnish the blood and nerve supply to the tooth. It is the living part of the tooth.

Various teeth in the mouth are held in place within the alveolus (socket) by means of the fibres which enable the teeth to undergo slight movements within the alveolus. These fibres that hold the teeth within the socket are called periodontal membrane.

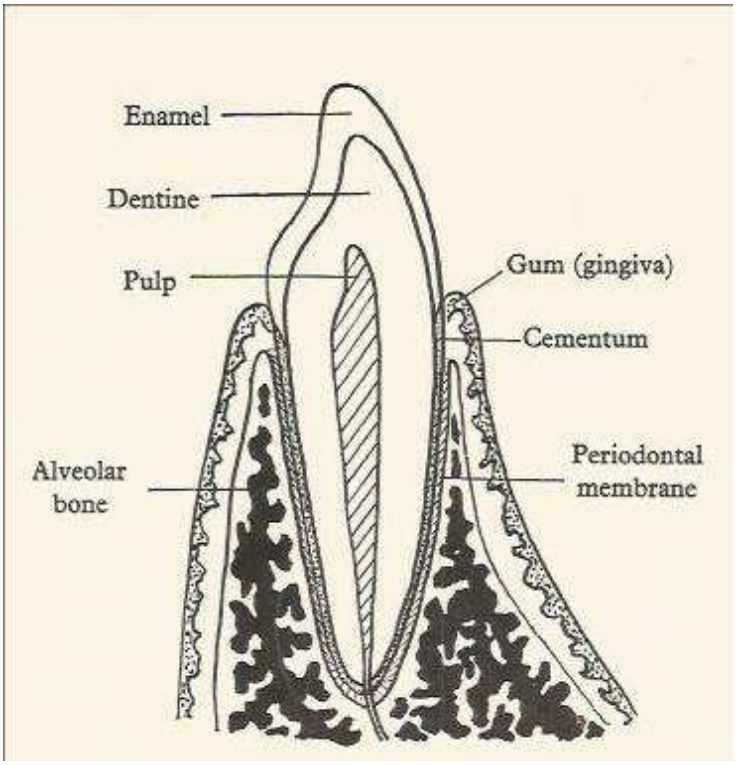

Fig. 1.2: Cross Section of a Tooth
Source: Shaw F.G & Scott D.C**.**

The teeth as typically discussed are the permanent teeth except where otherwise indicated. The permanent teeth are the ones which replace the milk teeth (teeth of infancy which are shed off) in a sequence of eruption that shows great variety. They are usually 32 in number as against the milk teeth that are 20.

The arrangement of these teeth helps in forming certain major landmarks in the shape of the mouth as they perform different roles. Their presence maintains the mouth in their ideal positions and ultimately the shape and aesthetics of the face as well as healthy condition.

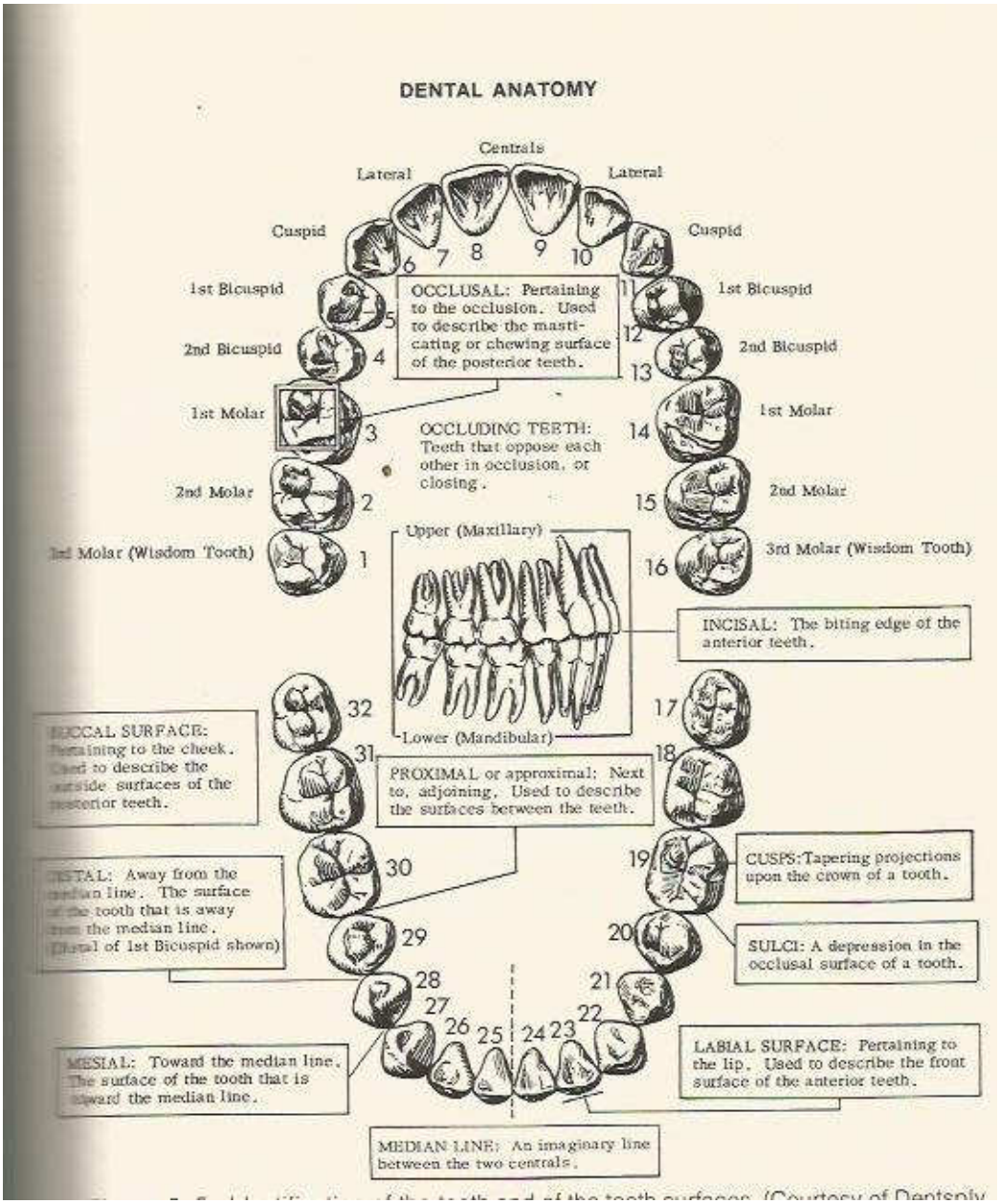

Fig. 1.3: Set of Teeth (Upper and Lower) indicating Surfaces

Source: Hudis, M.M.

3.3 Definition of Terms in Relation to the Characteristics Arrangement of the Teeth in the Mouth

This is the explanation of the meaning of certain terms, words or phrase to enable learners become acquainted or familiar with these words to ensure better and easy understanding of the subject matter.

Dentition:	Characteristics arrangement of teeth in the mouth.
Alveolar Ridge/Bone:	The portion of the upper jaw (maxilla) and the lower jaw (mandible) which support the teeth and keep them in position; or the upstanding of bone and its covering which remains after the extraction of teeth.
Axial Surface (of a tooth):	Any surface of a tooth which is parallel to the long axis of such tooth.
Apex of tooth:	Terminal end of the root of a tooth.
Root:	The portion of a natural tooth below the gum or gingiva.
Gingival:	The portion or surface of tooth nearest to the adjacent tooth.
Crown:	The portion of tooth above the gingival or gum.
Buccal:	The portion of a tooth touching the check.
Buccal Surface:	Pertaining to the cheek; used to describe the outside surfaces of posterior teeth.
Distal:	The portion or surface of the tooth that is away, farthest or furthest from the median line.
Mesial:	The Portion of a tooth nearest or toward the median line.
Median Line:	An imaginary line between the two central incisors.
Labial surface:	The portion of a tooth (anterior) facing the lips. Used to describe the front surface of anterior teeth.
Facial surface:	The portion of either anterior or posterior teeth nearest to the lips or cheek.
Incisal:	The cutting edge of the anterior teeth.
Cusp:	Tapering projections or elevations on the occlusal surface of posterior teeth.
Occlusal surface:	The chewing or masticating surface of posterior teeth.
Posterior teeth:	The teeth situated around the cheek or buccal region and are either double or multiple cusped.
Anterior teeth:	The teeth situated around the lips and are wedge shaped.
Cingulum:	The bulge at the base of the palatal or lingual surface of anterior crown.
Palatal surface:	The portion of the tooth nearest to the palate.

Lingual surface: The portion of the tooth nearest to the tongue.

Cervical: The narrow region at the junction of the crown with the root.

Neck: The portion of a tooth at the junction between the crown and root.

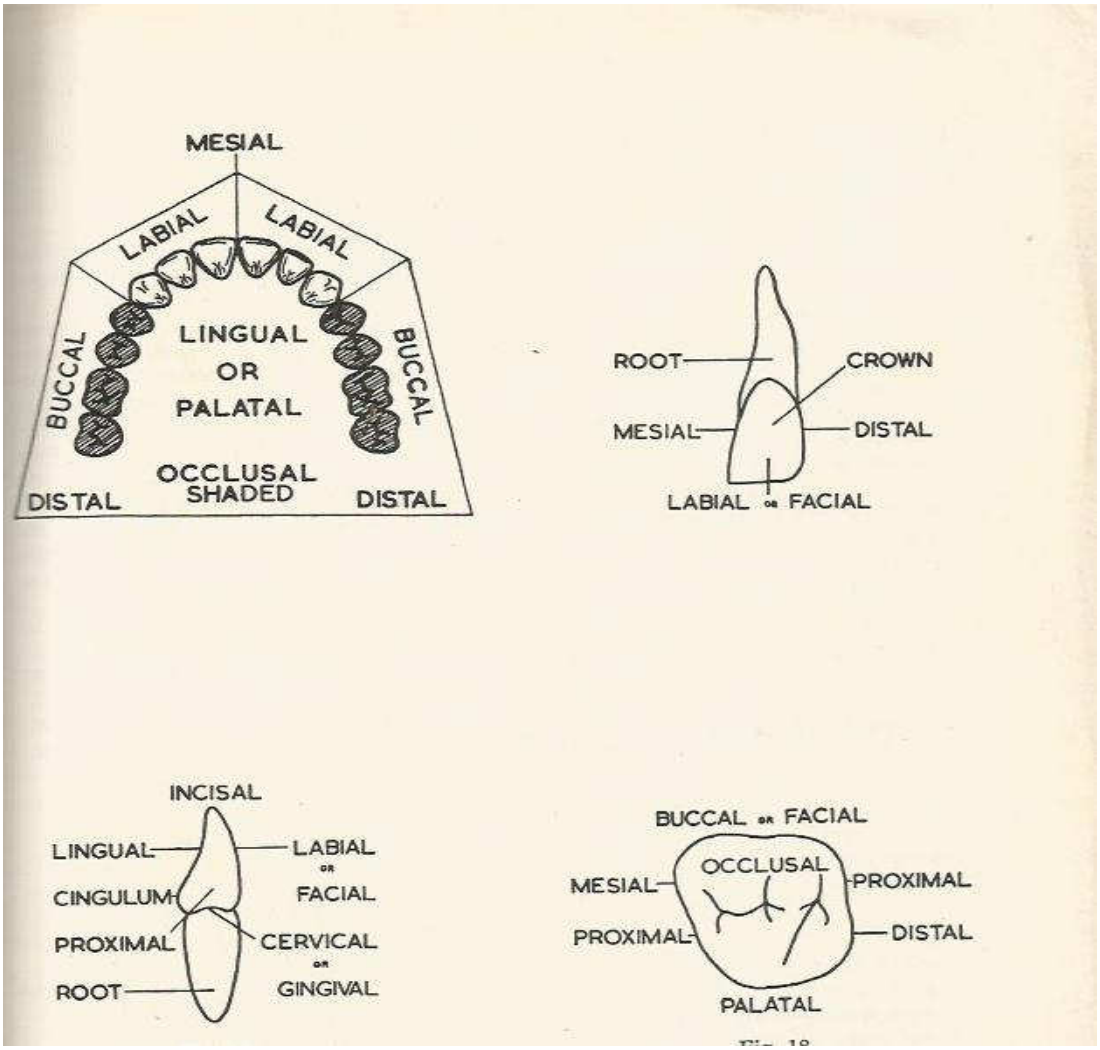

Fig. 1.4: Drawings showing the various sides of Dentition (Anterior & Posterior)

Source: Shaw F.G & Scott D.C.

4.0 CONCLUSION

In this unit, you learnt the characteristics arrangement of the teeth and the positions occupied by individual tooth in ensuring that the mouth is maintained in healthy condition. These have been achieved through the study of the denture bearing areas and their coverage. You have also looked at the teeth and their arrangements in the mouth as well as define the various terms associated with teeth, their arrangement and relationship to each other.

5.0 SUMMARY

In this unit, you have learnt about the landmark of denture bearing areas and how they play their roles in holding the appliance in position in the mouth. You have also learnt the basic elements making up the tooth and how they are held in position to ensure a healthy mouth. You have also studied the various terminology associated with the teeth and mouth which shall form the basis of your further studies. You are now on sound foundation upon which future studies will be based.

6.0 TUTOR-MARKED ASSIGNMENT

1. With the aid of a diagram, describe the upper denture bearing areas.
2. Draw and label a cross section of a tooth.
3. Define the following terminologies:
   a. Crown
   b. Cingulum
   c. Median line
   d. Palatal surface
4. Differentiate between palatal surface and lingual surface of tooth.

7.0 REFERENCES/FURTHER READING

Ash, M. M. (1984). *Wheelers Dental Anatomy, Physiology and Occlusion*. Philadelphia: W.B. Saunders Company.

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UNIT 2 DENTAL FORMULA

CONTENTS

1.0 INTRODUCTION

There are basic ways by which denomination and number of teeth for all mammals are expressed. This expression makes it very simple and straight forward to differentiate the various teeth in the mouth. This differentiation easily shows the type of tooth and their position in the different arches as well as shows whether it is for infants or for adults. This unit sets out to teach us these basic ways of notations and differentiation as it relates to the human teeth.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain deciduous teeth or teeth of infancy and their notations in the different arches of the mouth
- explain permanent teeth or teeth of adulthood and the various ways by which they are noted in the mouth
- identify the positions of the various teeth as they are shown on a chart
- enumerate the teeth in each classification.

3.0 MAIN CONTENT

3.1 Definition of Dental Formula

Dental formula has been defined by various authorities in different ways, but one definition which is all embracing and all encompassing is:

The Arrangement and number of teeth on the upper and lower jaws of one half of the oral cavity.

This definition captures the essence of the formula quotation because the formula, when stated, shows that the summation of the various numbers or figures as quoted will amount to half of the total stated.

$I^2/_2 \quad C^1/_1 \quad PM^2/_2 \quad M^3/_3 \quad = 32$

Where:

I = Incisor, while the $^2/_2$ indicates that there are two incisors on the upper jaw and two on the lower jaw of one half of the mouth. So also, the rest of the teeth in the mouth as notated.

C = Canine
PM = Premolars
M = Molars

As stated above, the summation of the various figures in the formula shows that it is half of the total quoted but a closer look and understanding of the formula informs us that the mouth is a complete organ and for half object to become complete, it is multiplied by two (2). Therefore, judging from the formula, the total is 16 but when multiplied by two (2) to make it whole or complete it becomes 32.

The figures above the horizontal line indicate uppers (upper jaw), while the ones below indicate the lowers (lower jaw). It will also be noted that the formula depicts that of adulthood or permanent dentition. This is usually the standard except otherwise stated in chart showing the teeth of infancy (milk teeth). Moreover, the milk teeth usually shed off giving way for the permanent teeth to emerge. The process requires about twenty (20) years to complete.

3.2 Classifications and Notations of Dental Formula

Dental formula is usually classified into two viz: deciduous and permanent teeth.

Deciduous teeth: This is the milk teeth of infancy and is observed to be fewer in number, usually twenty (20), and has no premolars and with dental formula:

$I^{2}/_{2}$ $C^{1}/_{1}$ $M^{2}/_{2} = 20$

Deciduous teeth are designated or notated in various ways viz.

(Patients right) (Patients left) (upper)

E D C B A	A B C D E
E D C B A	A B C D E (lower)

(A) (Palmer Notation)

(Patients right) (Patients left) (upper)

A B C D E	F G H I J
T S R Q P	O N M L K (lower)

(B) (Clinical Notation)

Patient's right Patient's left (upper)

55 54 53 52 51	61 62 63 64 65
85 84 83 82 81	71 72 73 74 75

(C) (Federation Dentaire International

(FDI) Tooth numbering system)

Where

	(A)	(B)	(C)
=central incisor	A | A A | A	E | F P | O	51 | 61 81 | 71
= lateral incisors	B | B B | B		
= canine	C | C C | C	C | H R | M	53 | 63 83 | 73
= 1st molars	D | D D | D	B | I S | L	54 | 64 83 | 74

= 2nd molars

E	E
E	E

A	J
T	K

Usually Deciduous teeth which are also referred to as primary teeth, milk teeth or teeth of infancy start developing at about the age of six (6) months with the lower/mandibular central incisors. The entire teeth remain in function from that age six (6) months till about eleven (11) to thirteen (13) years when they are completely replaced by the permanent dentition. In their notation, patient's upper right quadrant is denoted first and it goes in clockwise direction.

Permanent teeth/dentition: These are the teeth of adulthood. They emerge on shedding of the milk or deciduous teeth from the oral cavity. Permanent teeth/dentition are notated by numbers/figures and are immediately seen to be more in number than the deciduous dentition. They are used as the standard in quoting the dental formula.

$$I^2/_2 \quad C^1/_1 \quad PM^2/_2 \quad M^3/_3 \quad = 32$$

As can be seen from the formula, permanent dentition includes premolars (PM) which are absent in deciduous dentition.

The first to emerge in the mouth among the permanent dentition are the first molars which take place at the age of about six (6) years when the jaw growth has progressed sufficiently to allow it. The permanent dentitions are much larger than any deciduous teeth and are notated in different ways viz.

Patient's right (upper) Patient's left (upper)

8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8

(A) (Palmer notation) (lower)

Patient's right (upper) Patient's left (upper)

1 2 3 4 5 6 7 8	9 10 11 12 13 14 15 16
32 31 30 29 28 27 26 25	24 23 22 21 20 19 18 17

(B) (Clinical notation) (lower)

Patient's right (upper) Patient's left (upper)

18 17 16 15 14 13 12 11 | 21 22 23 24 25 26 27 28

48 47 46 45 44 43 42 41 | 31 32 33 34 35 36 37 38

(C) (FDI tooth numbering system) (lower)

Where

	(A)	(B)	(C)
=Central incisors	1 | 1 1 | 1	8 | 9 25 | 24	11 | 21 41 | 31
= lateral incisor	2 | 2 2 | 2	7 | 10 26 | 23	12 | 22 42 | 32
= canines	3 | 3 3 | 3	6 | 11 27 | 22	13 | 23 43 | 33
1st	=4 | 4 4 | 4	5 | 12 28 | 21	14 | 24 44 | 34
1st premolars	5 | 5 5 | 5	4 | 13 29 | 20	15 | 25 45 | 35
=2nd premolars	7 | 7 7 | 7	2 | 15 31 | 18	
=1st molars	8 | 8 8 | 8	1 | 16 32 | 17	18 | 28 48 | 38
=2nd molars			

= 3rd molars or

"wisdom teeth"

The permanent dentition are what humans live with all through life and any untoward effect on any of them may lead to the use of restorative

appliance for correction or replacement. The vertical line bisects the face and dentition into two (2) halves while the horizontal line demarcates the upper jaw and lower jaw.

4.0 CONCLUSION

In this unit, you have learnt the definition of dental formula. The unit has classified dentition as deciduous and permanent dentition and has also given us both the formulas of each dentition as well as the charts and various notations of each dentition. It is hoped that this unit forms the background for subsequent units.

5.0 SUMMARY

In this unit, you have been acquainted with deciduous/milk/primary teeth or teeth of infancy and their notations as advocated for by different authorities. You also learnt the permanent teeth which the adults live with all through life. You have also learnt the numbers of teeth making up each dentition and the positions they occupy in the mouth.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define dental formula.
2. Using the FDI or quadrant number notation, chart deciduous dentition.
3. Differentiate between deciduous and permanent dentition.
4. How do you chart the teeth on patients' upper right using the palmers notation.

7.0 REFERENCES/FURTHER READING

Andlaw, R. J & Rock, W. P. (1996). *A Manual of Pediatric Dentistry.* Edinburgh: Churchill Livingstone.

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UNIT 3 DECIDUOUS DENTITION

CONTENTS

1.0 INTRODUCTION

The formation of teeth and their development involve some closely related processes which are closely linked to the changes which take place with the growth of the jaws.

Knowledge of the sequence of the formation and eruption of teeth generally and deciduous teeth specifically are of great importance. The first appearance of teeth in a child is eagerly awaited by parents since it represents important early milestone in the child's development. This is because once deciduous dentition is completed; the dimensions and form of the arches change reduce significantly until permanent dentition begin to erupt. It is therefore very pertinent that deciduous teeth, their development and etiology are studied as they play a part in influencing learning of feeding attitude especially the imbibing of masticatory skills.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain calcification and eruption of the first set of primary teeth in individual's life
- chronicle the sequence of eruption and shedding of deciduous teeth
- describe occlusal relationship of deciduous teeth
- explain the transition between deciduous dentition and permanent dentition.

3.0 MAIN CONTENT

3.1 Definition of Deciduous Dentition and Associated Concepts

Deciduous dentition is the teeth of infancy associated with childhood. They contain fewer numbers of teeth (20) in comparison with the permanent dentition (32). Their formation is closely related to prenatal and postnatal development period. Their formation dates back to four (4) to five (5) months of intrauterine life (when in the womb) but its eruption in the mouth starts six (6) to seven (7) months after birth and complete eruption between two and a half ($2^1/_2$) years to three (3) years of age. This dentition remains intact until the child is about six (6) years when transition to permanent dentition starts. The number of deciduous teeth remains twenty (20) except if any misses congenitally or as a result of disease or trauma. The denomination of deciduous teeth is by the initial of the three (3) sets of teeth that make it up,

I = Incisor, C= Canine, M= molar
They are represented typically thus

$I^2/_2 \quad C^1/_1 \quad M^2/_2 \quad = 20.$

3.1.1 Terminologies or Concepts Associated with Deciduous Dentition

Calcification:	The deposition of lime salts in the formation of tooth/teeth. This begins in the four to five months of intrauterine life.
Eruption:	Is the coming out or appearance of natural teeth in the oral cavity. This begins at six to seven months after birth.
Mandibular:	Refers to lower jaw or mandible.
Maxillary:	Refers to upper jaw or maxilla.
Anodontia:	Total absence of teeth in the mouth.
Hypodontia:	Absence of few teeth in the mouth.
Oligodontia:	Absence of many teeth but not all in the mouth.
Exfoliation:	Is the shedding of deciduous teeth to enable the succedanous teeth (permanent) to replace them.
Transition:	Is the period when the permanent dentition starts to emerge to replace the deciduous dentition, beginning with the first molars. This starts at about six years of the child.

3.2 Developmental Chronology of Deciduous Teeth

This is the sequence by which deciduous teeth develop beginning with calcification of such teeth during the prenatal age to the day of eruption till the day of complete development of roots of the teeth.

Table 3.1: Developmental Chronology of Deciduous Teeth

Upper deciduous teeth	Evidence of calcification	Completion of crown	Eruption	Completion of root after birth
Incisors	3-5 months in utero	4-5 months	6-9 months	$1^1/_2$-2years
Canines	5-6 months in utero		16-20 months	$2^1/_2$-3years
Molars	5-6 months in utero	6-12 months	12-30 months	2-3years
Lower deciduous incisors	4.5 months in utero	4-4.5 months	6.5-7 months after birth	$1^1/_2$-2 years
Canine	5months in utero	9months	16-20 months	$2^1/_2$-3 years
Molars	5-6months in utero	6-12 months	12-30 months	years

3.3 Importance of Deciduous Dentition

The eruption of deciduous dentition at the stage they do play a vital role in the behaviour of the child in feeding especially the learning of masticatory skills. They play key role in the maintenance of space for the eruption of permanent teeth and normal occlusion otherwise malocclusion occurs.

Presence of deciduous dentition helps a great deal in maintaining the integrity of the arch as well as the beauty of the face. Without teeth, every pressure applied in the mouth goes direct to the oral tissues, hard and soft.

Therefore, presence of deciduous dentition in the mouth of a child helps a lot in protecting and preserving the oral tissues which would have otherwise been damaged.

Deciduous dentition also plays an important role in the pronunciation of words, clearly.

4.0 CONCLUSION

Having gone through this unit successfully, you have learnt the definition and basic concepts relating to deciduous dentition. The sequence or chronology of the development of deciduous dentition which indicates that teeth start developing in the womb at about four (4) months of intrauterine life but starts to manifest itself in the mouth from about six (6) months after birth. The importance of deciduous dentition has also been studied.

5.0 SUMMARY

In this unit, you have learnt about the calcification and eruption of deciduous teeth. You have also learnt the sequence of development of the first set of teeth in humans and when they start falling off the mouth giving rise to steady and permanent teeth. This unit had also shown us when the permanent teeth start erupting which is at about six (6) years of age of a child.

6.0 TUTOR-MARKED ASSIGNMENT

1. With the aid of dental formula, describe deciduous dentition.
2. At what time do the lime salt which is responsible for the formation of teeth start.
3. At what range of time do the eruption of deciduous teeth complete.
4. Give two reasons why deciduous dentition is important.

7.0 REFERENCES/FURTHER READING

Andlaw, R. J. & Rock, W. P. (1996). *A Manual of Paediatric Dentistry*. Edinburgh: Churchill Livingstone. pp. 129-134.

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UNIT 4 PERMANENT DENTITION

CONTENTS

1.0 INTRODUCTION

In describing human teeth, usually the permanent dentition is used as a standard except where otherwise stated. This dentition also referred to as adult teeth play a vital role in the preservation of oral health of every individual as well as the aesthetics of such individual. The presence of teeth in the mouth help a lot in directing and restricting jaw movements which would have otherwise caused some wide and maybe dysfunction of the Temporo Mandibular Joint (TMJ). As it is known, the teeth at this level are one part of the strongest bones in the body and are completed after the deciduous teeth have exfoliated. Permanent dentition contains 32 teeth in four (4) sets viz Incisor, four (two upper, two Lower); Canine two (one upper, one lower): premolars four (two upper, two lower) molars six (three upper, three lower) on one half of the arches (dental formula).

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- distinguish between deciduous and permanent dentition
- serialise the sequence of eruption of permanent dentition
- identify the functions and importance of each of the teeth making up permanent dentition.

3.0 MAIN CONTENT

3.1 Definition of Permanent Dentition

This is the teeth of adulthood which start appearing in the mouth at the age of about six (6) years even while the deciduous teeth are not completely exfoliated. They start manifesting with the first molars which erupt distally to the deciduous second molars.

The permanent dentition is represented in different ways by a way of notation and represents the dental formula when stated except where stated otherwise.

$I^2/_{2,}\ C^1/_{1,}\ \ PM^2/_{2,}\ M^3/_3 \quad = 32$

Notation or charting of permanent dentition goes this;

Upper Right	Upper Left
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8
Lower Right	Lower Left

(A) (Palmer's notation)

Upper Right	Upper Left
18 17 16 15 14 13 12 11	21 22 23 24 25 26 27 28
48 47 46 45 44 43 42 21	31 32 33 34 35 36 37 38
Lower Right	Lower Left

(B) (FDI Tooth numbering system)

Upper Right	Upper Left
1 2 3 4 5 6 7 8	9 10 11 12 13 14 15 16
32 31 30 29 28 27 26 25	24 23 22 21 20 19 18 17
Lower right	Lower left

(C) (Clinical notation)

Where

(A)	(B)	(C)	
1 | 1 1 | 1	11 | 21 41 | 31	8 | 9 25 | 24	Central incisors
2 | 2 2 | 2	12 | 22 42 | 32	7 | 10 26 | 23	Lateral incisors
3 | 3 3 | 3	13 | 23 43 | 33	6 | 11 27 | 22	Canines
4 | 4 4 | 4	14 | 24 44 | 34	5 | 12 28 | 21	1st premolars or 1st bicuspids
5 | 5 5 | 5	15 | 25 45 | 35	4 | 13 29 | 20	2nd premolars or 2nd bicuspids
6 | 6 6 | 6	16 | 26 46 | 36	3 | 14 30 | 19	1st molars or "6 year molars"
7 | 7 7 | 7	17 | 27 47 | 37	2 | 15 31 | 18	2nd molars
8 | 8 8 | 8	18 | 28 48 | 38	1 | 16 32 | 17	3rd molars or "wisdom teeth"

From the foregoing, it is seen that though different notations, they all mean the same thing; showing that permanent dentition contain 32 teeth.

3.2 Identification of Distinguishing Factors in Permanent Dentition

As stated previously, permanent teeth start erupting at about the age of six years with first molars. They exhibit major contrast or difference with the deciduous dentition which can be summed up thus;

a. *Size*: Much larger in size than deciduous dentition.
b. *Crowns dimensions*: On comparison, the crown dimensions of permanent dentition are seen to be longer in length (incisor-cervical) than mesio-distal when measured. Generally, the crowns

of permanent dentition are much more larger than deciduous dentition.

c. *Colouration*: The permanent teeth are seen to be much more coloured than deciduous teeth of the same patient. The deciduous dentition are whiter in colour.

d. *Bucco-Lingual surface*: The buccal and lingual or palatal surfaces of permanent dentition are more pronounced, more prominent thereby making the occlusal surface larger.

e. *Other features*: The crown of upper 1st molar at six (6) years, carries a tiny /small cusp-like projection on the palatal side of the mesio-palatal cusp. This small cusp-like projection is referred to as "cusp of Carabelli" and it distinguishes the tooth from every other tooth in the mouth.

3.3 Chronology or Sequence of Eruption of Permanent Dentition

As earlier stated, the six year molars are the first set of teeth to emerge among the permanent dentition. They are followed by the central incisors which emerge between the age of six and seven years of patient. The lower central incisors precede the uppers. This is closely followed by the lateral incisors. The next on the sequence is the maxillary/upper central incisors followed by the lateral incisors which appear after about one year. Sequel to the eruption of upper lateral incisors, are the mandibular canines. These usually are preceded by the first premolars but sometimes they appear simultaneously. Followed next is the second premolars which erupt at about a year later and then maxillary canines. The second molars which erupt when individuals are about 12 years old appear posterior to the first molars and in some cases, they erupt at the same time with upper canines. The last teeth to erupt are the third molars and they complete the process of eruption, usually when the individual is about 17 years old.

Therefore the summary of the sequence of eruption (permanent dentition) can be described in this order:

1. 1st molars at about 6 years
2. Mandibular (lower) central incisors: 6-7 years
3. Mandibular (lower) lateral incisors: 7-8 years
4. Maxillary (upper) central incisors: 7-8 years
5. Maxillary (upper) lateral incisors: 8-9 years
6. Mandibular canines: 9-10 years
7. 1st premolars: 10-12 years
8. 2nd premolars: 10-12 years
9. Maxillary canines: 11-12 years
10. 2nd molars: 12-13 years

11. 3rd molars: 16-21 years.

The above can be tabulated thus:

Table 4.1: Sequence of Eruption of Permanent Dentition

Maxilla sequence	Tooth involved in eruption	Mandibular sequence	Tooth involved in eruption
1	1st molar 6 years	1	1stmolar 6 years
2	Central incisors 7-8 years	2	Central incisors 6-7 years
3	Lateral incisors 8-9 years	3	Lateral incisors 7-8 years
4	1st premolars 10-12 years	4	Canines 9-10 years
5	2nd premolars 10-12 years	5	1st premolars 10-12 years
6	Canines 11-12 years	6	2nd premolars 11-12 years
7	2nd molars 12-13 years	7	2nd molars 11-13 years
8	3rd molars 16-21 years	8	3rd molars 16-21 years

The "chronology of Human dentition" was reported by Loban and Kronfeld in 1933 and modified later by McCall and Schour (1944) but simplified in this text for easy and better understanding.

3.4 Importance of Permanent Dentition

Dentition which is part of human body will help to maintain and retain the health of other physiologic structures that are involved in mastication, deglutition or swallowing, phonetics and breathing. Aside these, the teeth posses certain feature which are designed to provide some level of protection to the surrounding tissues, maintain the integrity of the arch and facial structure (aesthetics).

To protect the investing and surrounding structures, the teeth are shaped to deflect food away from the highest point of the tissues. The contact area of teeth protects the gingiva between them in the interproximal spaces. The positioning of the teeth in both jaws are such that the maxillary teeth overhang the mandibular teeth and this ensures that the tissues of the lips and cheeks are protected from being torn when the teeth are in occlusion and the deflection of food away from the gingiva prevents irritation and eventual recession of gingival tissues from the neck of the teeth and the deposition of food debris which will ultimately

cause periodontitis. The teeth arrangement which bring about curve of spee, considering the position of incisal edges of anterior to the occlusal surface of molar, bear a strong relationship to the movement of the jaw as it moves downward and forward on opening. The presence of this cure of spee and the curve of monsoon, the positioning of posterior teeth in such a way that the buccal cusps of lowers are on higher plane than the lingual cusps, bring about "balanced occlusion". These functions of the teeth are of great importance in maintaining the physiologic condition of the mouth that present no pathologic changes in the supporting tissues. They also play vital role in keeping the shape of the face (aesthetics) as the loss of any single one will cause the integrity of the arch to disintegrate.

4.0 CONCLUSION

Having successfully gone through the unit, you learnt the meaning of permanent dentition and known how to identify the various individual teeth. You have also learnt the features that distinguish the permanent teeth from deciduous teeth as well as the order or sequence of eruption of permanent teeth. Finally, you learnt the importance of permanent dentition which play vital role which among other things but not limited to mastication, swallowing of food, preservation of oral tissues and maintenance of oral integrity and well as facial structures (aesthetics).

5.0 SUMMARY

This unit has been able to distinguish the permanent dentition from deciduous dentition. It has also serialised the sequence of eruption of permanent teeth and identified the importance of permanent dentition without which physiologic changes will occur and eventually pathologic conditions will set in.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define permanent dentition and using palmer's notation.
2. Identify the individual tooth.
3. Write a short note on the sequence of eruption of permanent dentition.
4. Write a brief note on the importance of dentition.

7.0 REFERENCES/FURTHER READING

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UNIT 5 TOOTH MORPHOLOGY

CONTENTS

1.0 INTRODUCTION

In the previous unit, you learnt about permanent dentition and in this unit you are going to look at the structure and shapes of teeth in the mouth. I hope you will find it very interesting.

The various teeth in the dental arches are known to be unidentical to each other though some resemble each other or those adjacent to them especially in a particular arch and quadrant. The upper teeth differ to a great extent from the lowers while those from one particular quadrant are different from those on the opposite quadrant.

These differences impact different shapes to both the jaw and the face thereby enabling different people to posses different face structure/ appearance. Therefore the knowledge of the various shapes is very important as it enables the dental technologist to identify each tooth and the age related changes they undergo.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- describe and draw individual tooth from the different five surfaces
- differentiate the various teeth in the mouth
- carve the individual tooth form
- recognise the different classes of teeth shape (mould).

3.0 MAIN CONTENT

3.1 What is Tooth Morphology?

Tooth morphology is the study or knowledge of the teeth/tooth by their shapes and the features they posses.

It is very pertinent and of absolute importance that a dental technologist should have a detailed knowledge of the structure and shape of the various teeth so as to aptly identify each and every one of them. The morphology of the teeth in each group reflects the functions they perform-cutting, tearing, holding, crushing etc.

There are age related changes which the various teeth undergo. The knowledge of all these enable proper selection of teeth during design and fabrication of prosthodontic appliances as well as carving done accurately in crown and bridge works ranging from single tooth morphology to alignment in the mouth as well as stimulation of natural features.

Teeth on the various arches are therefore classified into two viz. (i) anteriors (ii) posteriors.

i. Anteriors: Comprise the twelve (12) wedge-shaped teeth that are near the lips. They run from canine to canine in both arches (six on the upper arch, six on the lower arch).
ii. Posteriors: Comprise the other twenty (20) situated farthest from the lips and around the buccal or check region. They have either double or multiple cusps and run from 1st premolar to 3rd molar in both arches (ten on the upper arch, ten on the lower arch).

3.2 Why the Study of Tooth Morphology?

Human teeth are arranged in both upper and lower jaws. The position, shape and angulations of each tooth have a definite influence upon the function of each arch.

The incisors are designed for piercing, cutting and tearing; canines tear and hold; and also tend to support the incisors; premolars and molars which have double and multiple cusped occlusal surfaces crush and grind food. Teeth therefore enable humans to obtain, chew and digest food.

Detailed study of the shape and features of individual teeth in the mouth is very important as this will enable one who intends carrying out teeth selection, design and construction of appliances as well as carving for

crowns and bridge done accurately bearing in mind that artificial substitutes should replace the forms and functions of the natural dentition which they replace without interference with opposing or other associated tissues or evoking pathological changes.

Natural dentitions have their relationships to each other when in occlusion so also, artificial substitutes ought to have their relationships in occlusion. Detailed knowledge of these relationships is very necessary to enable maintenance of same relationship by prostheses as deviation or change can possibly evoke pathology.

3.3 Individual Tooth Form/Landmarks described in Detail Anteriors

Maxillary Central Incisor

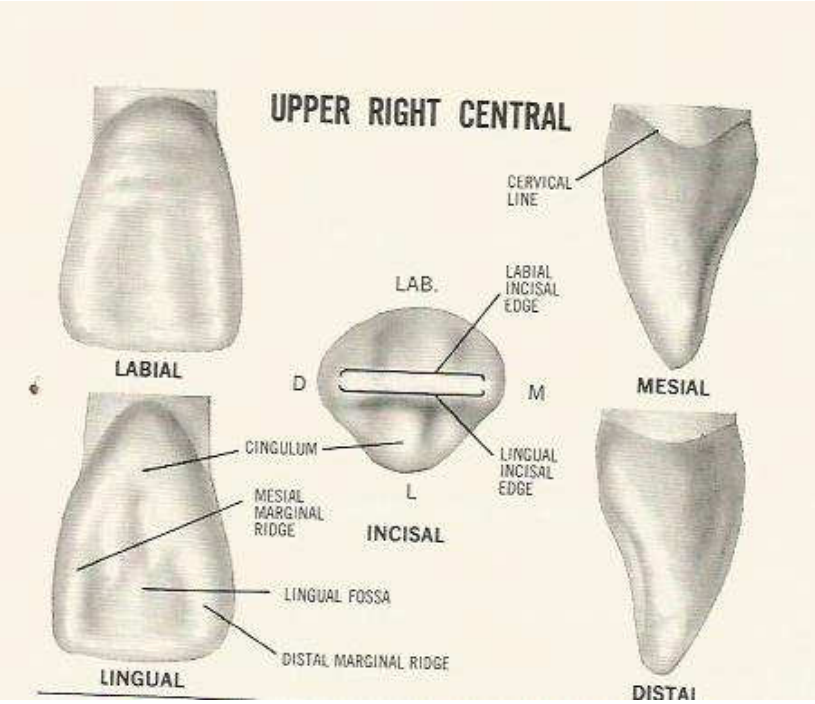

Fig. 5.1: Maxillary Central Incisor showing the Various Sides and Features

Source: Hudis, M.M.

Main Shape

They are ovoid, square or tapering. It is usually longer and wider than adjacent tooth. Mesial aspect of incisal edge more pointed than distal aspect which is more rounded. It has single root.

The labial aspect of the crown is smooth and convex though less convex than the maxillary lateral and canine.

The palatal surface is reverse of the labial; contains convexities and concavities thereby making it irregular which is bordered by the mesial and distal marginal ridges which flow towards the cingulum to give a scooplike shape to the crown (the palatal fossa).

Maxillary Lateral Incisor

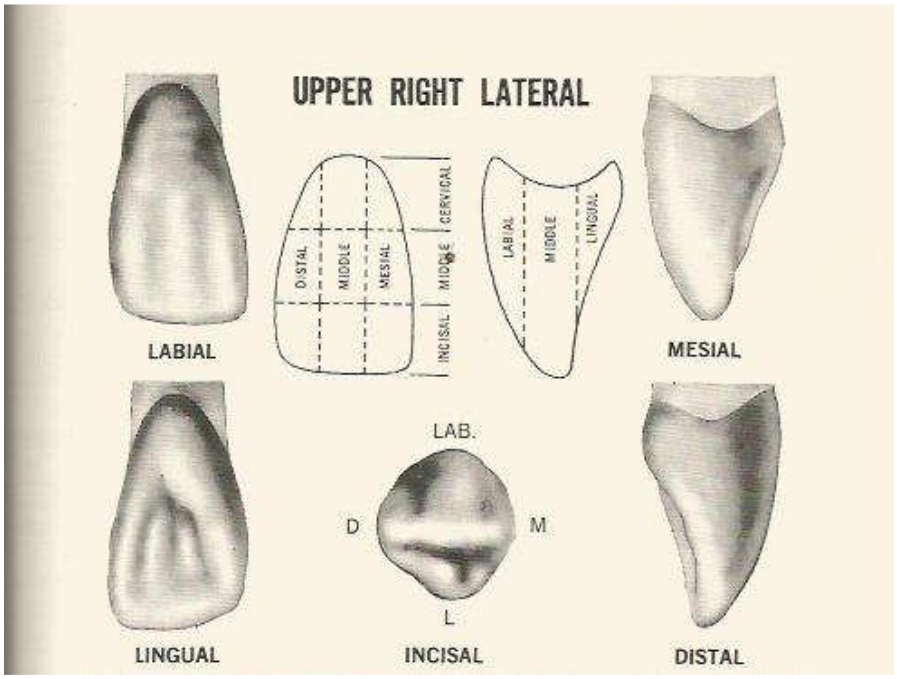

Fig. 5.2: Maxillary Lateral Incisor Showing the various Sides and Features

Source: Hudis, M. M.

Main Shape

They are ovoid, square or tapering. It is usually shorter or narrower than maxillary central. The mesial aspect of incisal edge is more rounded than central. Distal outline from incisal edge is almost semicircle in shape. Has single root. The labial aspect corresponds to that of the central incisor but in smaller proportion.

Maxillary Canine or Cuspid

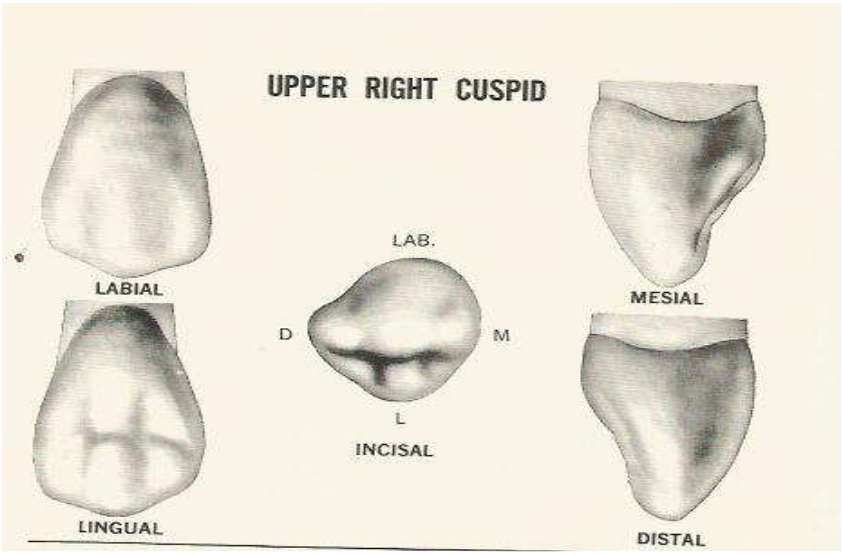

Fig. 5.3: Maxillary Canine or Cuspid showing the Various Sides and Features

Source*:* Hudis, M. M.

The incisal edge is pointed. The distal incline of cusp is longer than mesial incline. The length is almost that of central incisor and has single root which is longest in the mouth. The cusps tip is in line with the root. The labial surface is smooth with slight depression mesially and distally.

Mandibular Central Incisor

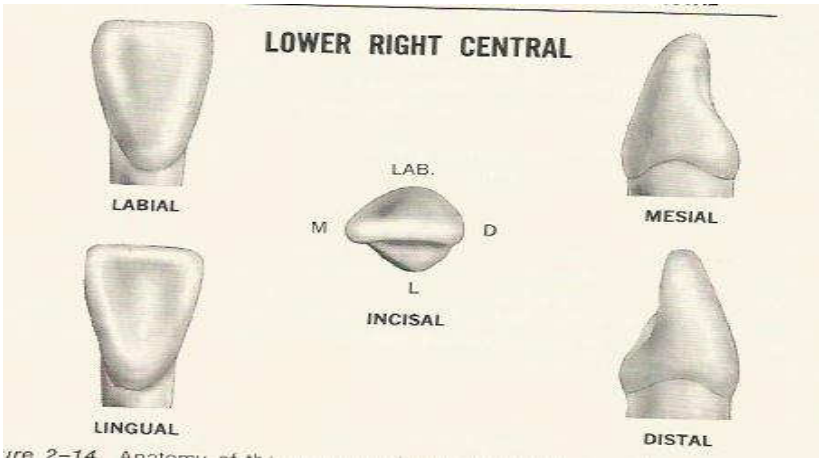

Fig. 5.4: Mandibular Central Incisor showing the Various Sides and Features

Source: Hudis, M. M.

Main Shape

This is the smallest of all natural teeth. The mesial aspect of the incisal edge has more acute angle than the distal. Looks like an inverted triangle with the base being at the incisal edge, when viewed labially. When viewed from the mesial or distal surface, it looks triangular also with the base of the triangle at the cervix. It has a single root.

Mandibular Lateral Incisor

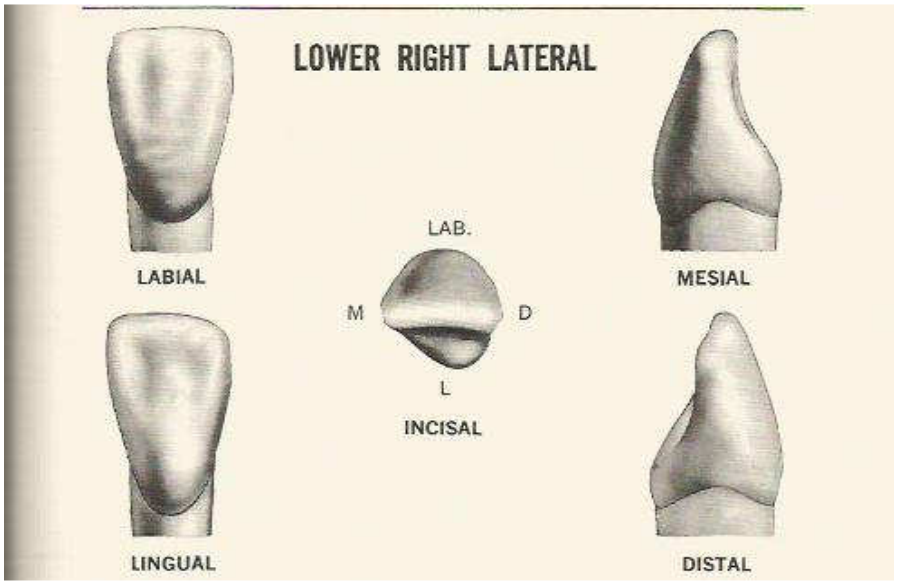

Fig. 5.5: Mandibular Lateral Incisor showing the Various Sides and Features

Source: Hudis, M. M.

Main Shape

Similar to mandibular central incisor but slightly larger and wider. The mesial aspect of crown appears to have a more acute angle that the distal and this causes the incisal edge to slope distally. Has single root that is somewhat longer than that of mandibular central incisor.

Mandibular Canine

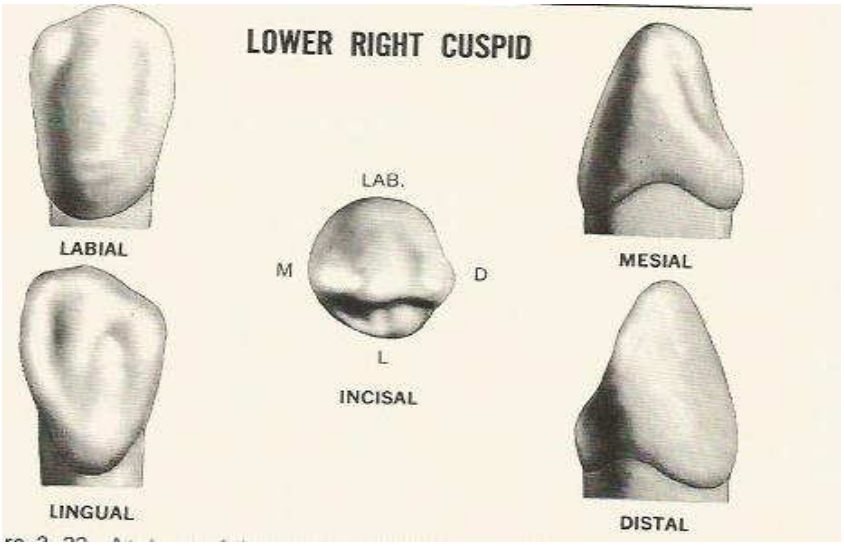

Fig. 5.6: Mandibular Canine/Cuspid showing the Various Sides and Features

Source: Hudis, M. M.

Main Shape

The distal incline of cusp is longer than the mesial. Largest of all lower anterior teeth. When viewed from the labial side, it presents a pentagonal outline and when viewed from the mesial or distal aspect, it is triangular with the base of the triangle being toward the cervix. Has single root. The cusp edge is in line with the root.

Posteriors
Maxillary Posteriors
Maxillary 1st Premolar (1st Bicuspid)

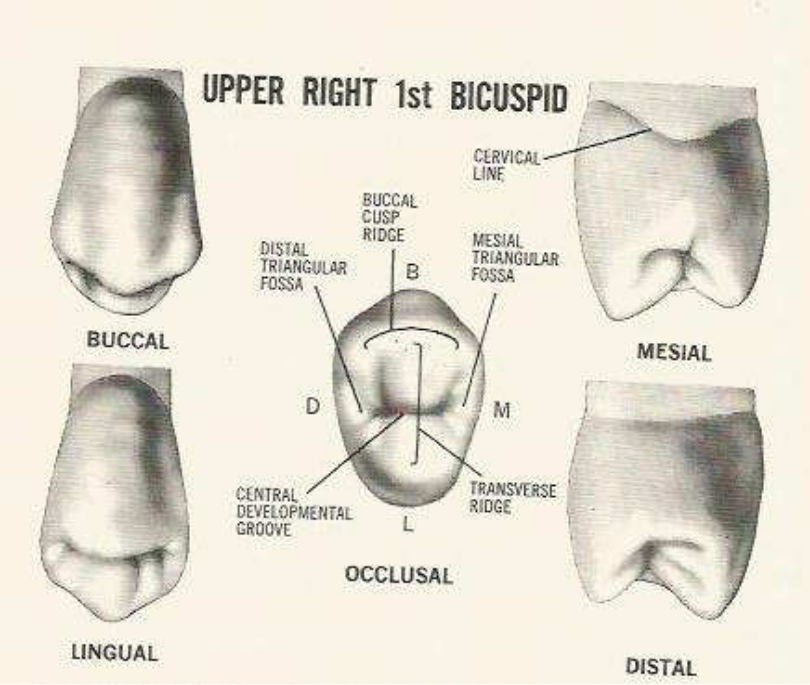

Fig. 5.7: Maxillary 1st Premolar showing the Various Sides and Features

Source: Hudis, M. M.

Main Shape

Has two (2) cusps; one buccally, one palatally of which the buccal cusp is slightly larger than the palatal cusp. Occlusal area of 1st premolar is a little larger than that of 2nd premolar. The occlusal shape shows trapezoidal form with a well defined central developmental groove that divides the surface evenly. Mesio-Distal fissure is longer than that of 2nd premolar. Has two (2) roots.

Maxillary 2nd Premolar (Bicuspid)

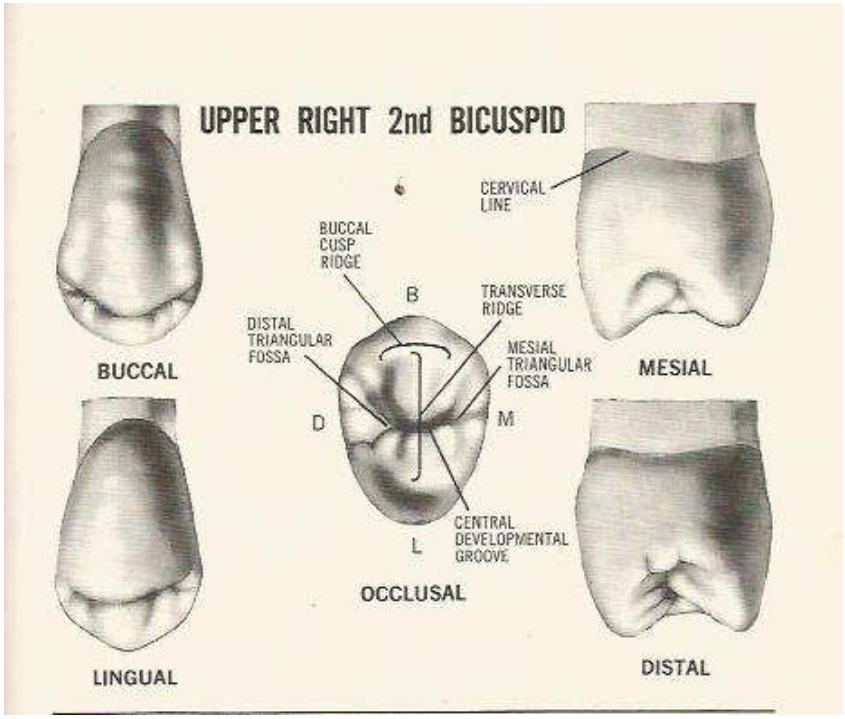

Fig. 5.8: Maxillary 2nd Premolar/Bicuspid showing Different Sides end Features

Source: Hudis, M. M.

Main Shape

Has two cusps; one buccally, one palatally. Slightly smaller than 1st premolar and more rounded. The buccal cusp is not as long as that of 1st premolar and less pointed. Has one root which appears longer than that of 1st premolar.

Maxillary 1st Molar

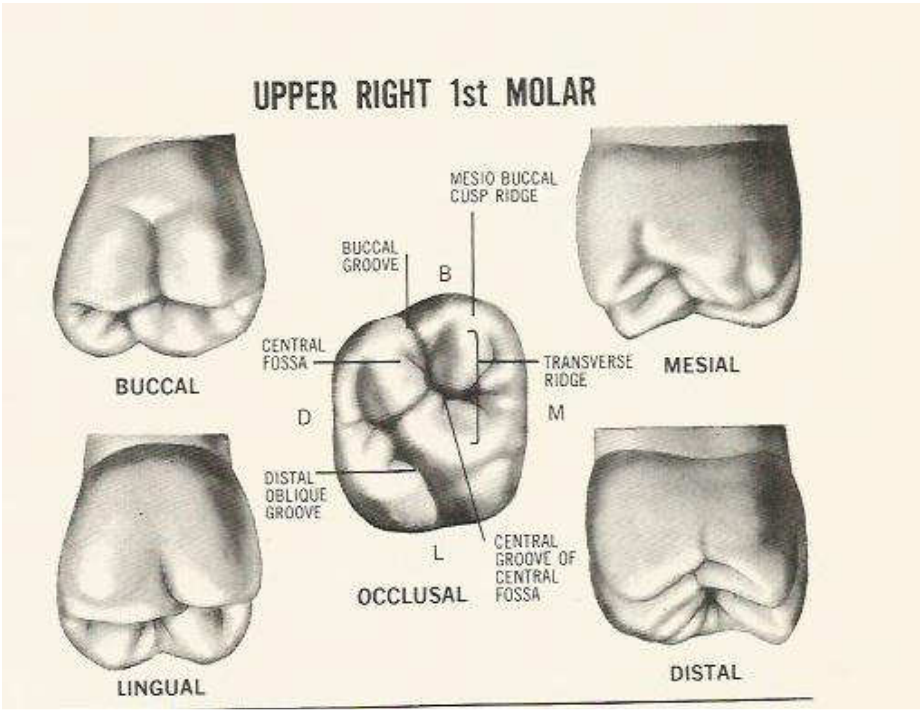

Fig. 5.9: Maxillary 1st Molar showing the Various Sides and Features

Source: Hudis, M. M.

Main Shape

Has four cusps; two (2) buccally, two (2) palatally. The buccal development groove divides the buccal cusps with the mesio-buccal cusp being broader than disto-buccal cusp. Mesio-palatal cusp being the largest. When the tooth is viewed from the occlusal surface, it is rhombic but when viewed from the buccal aspect, it is trapezoidal. Sometimes, there is a fifth cusp which develops from the side of the mesio-palatal cusp. This cusp is referred to as “cusp of carabelli”. Has three (3) roots.

Maxillary 2nd Molar

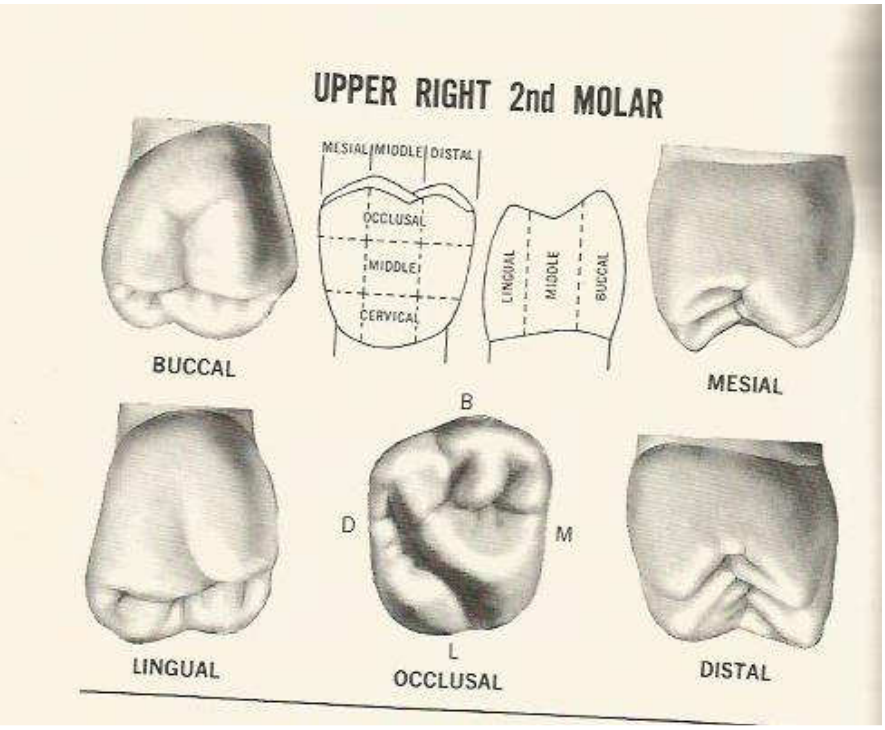

Fig. 5.10: Maxillary 2nd Molar Showing the various Sides and Features

Source: Hudis, M.M.

Main Shape

Similar to maxillary 1st molar but smaller. When viewed from the buccal aspect, the outline is roughly trapezoidal but when viewed from the occlusal aspect, it is rhombic. Has two (2) roots.

Mandibular 1st Premolar (1st Bicuspid)

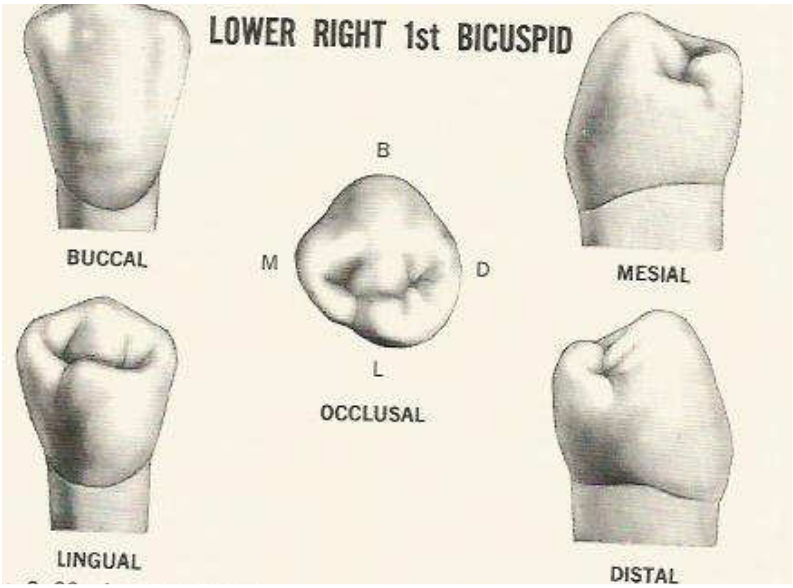

Fig 5.11: Mandibular 1st Premolar showing the Various Sides and Features

Source: Hudis M. M.

Main Shape

Has two (2) cusps; one buccally, one lingually; with the buccal cusp being much larger than lingual cusp. When viewed from the buccal surface, the mesial and distal slopes/outlines are almost identical. The larger buccal cusp covers the lingual cusp. The occlusal area of 1st premolar is less in extent than 2nd premolar. When viewed from the occlusal surface, the outline is roughly diamond-shaped. Has single root.

Mandibular 2nd Premolar (Bicuspid)

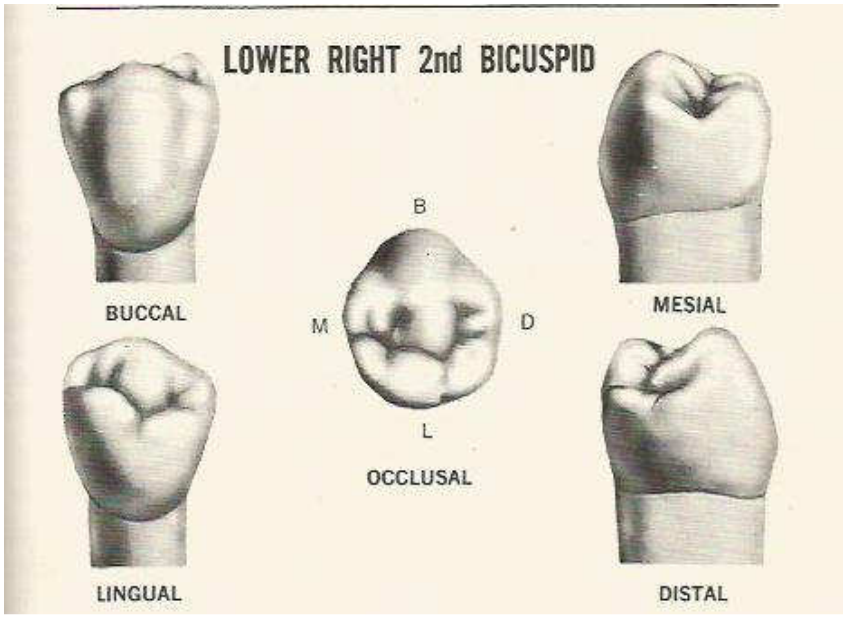

Fig. 5.12: Mandibular 2nd Premolar showing the Various Sides and Features

Source: Hudis, M. M.

Main Shape

Has two (2) cusps; one buccaly, one lingually, but may sometimes have three (3) cusps, one buccally and two (2) lingually. The buccal cusp being the largest followed by the mesio lingual cusp.

The three (3) cusp type has triangular ridges on the occlusal surface. These ridges are separated by a developmental groove to give a "Y"shape. The occlusal area is larger than the mandibular first premolar. When viewed from the buccal aspect, the outline is trapezoidal and when viewed from the occlusal surface, the outline is roughly rounded. Has single root.

Mandibular 1st Molar

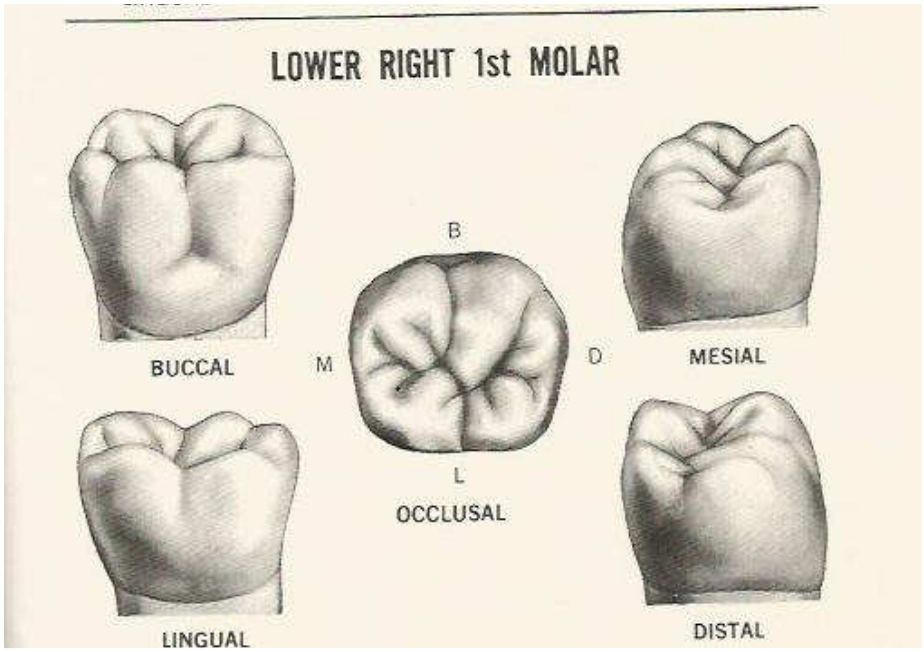

Fig. 5.13: Mandibular 1st Molar showing the Various Sides and Features

Source: Hudis, M. M.

Main Shape

Has five (5) cusps; three (3) buccally, two (2) lingually. The mesio lingual cusp being the largest. It is the broadest of all natural teeth. The occlusal view shows a hexagonal shape. The buccal view shows a trapezoidal shape. Two (2) prominent developmental grooves, mesio-buccal groove and disto-buccal groove are seen on the occlusal surface. These developmental grooves converge in the central fossa at the central pit. Has two (2) roots with the mesial root most times being more broad than the distal root.

Mandibular 2nd Molar

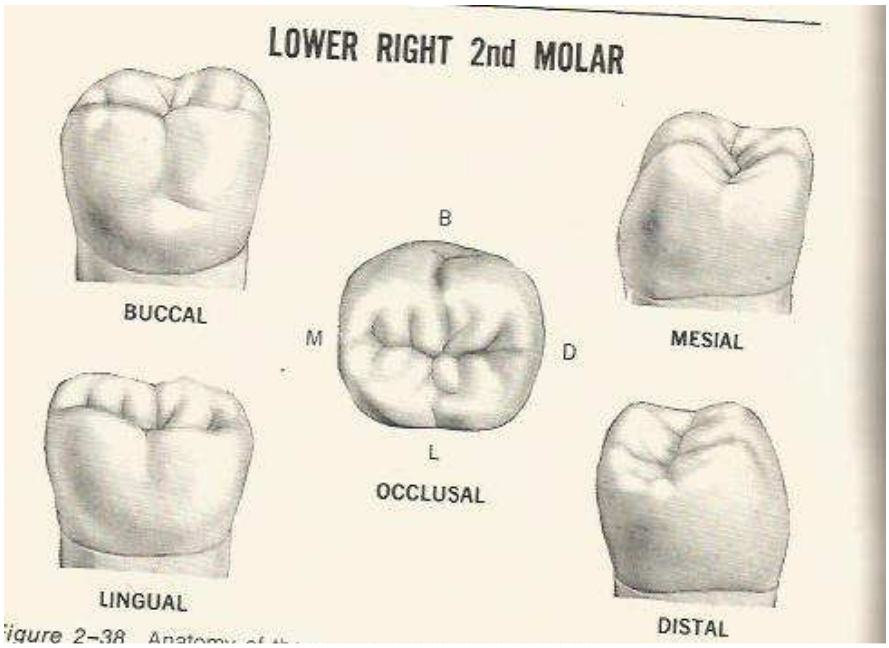

Fig. 5.14: Mandibular 2nd Molar showing Various Sides and Features

Source: Hudis, M. M.

Main Shape

Has four (4) cusps; two (2) buccally and two (2) lingually. It is less in extent than mandibular 1st molar. Has one developmental groove on the buccal aspect. The buccal view is trapezoidal in outline while the occlusal view is rectangular. Has two (2) roots of which the mesial root appears larger than the distal.

4.0 CONCLUSION

Having successfully gone through this unit, you learnt what tooth morphology means and the reason why we study it; which is to know about the shape and features of individual tooth in the mouth. This will help us as Dental Technologists to undertake our teeth selection, design and construction of appliances accurately. You also learnt the major landmark features of individual teeth.

5.0 SUMMARY

This unit differentiated the various classes of teeth as well as various features of these teeth. It has taught us the various shapes, (ovoid, square and tapering) associated with human teeth. It has also taught us the parts of a tooth viz. crown, neck and root. It is hoped that we can now differentiate and select individual tooth from the pool of teeth based on shape and features.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is tooth morphology and why is it important for a Dental Technologist to be abreast with it?
2. Describe the board categorisation of the teeth in the mouth.
3. With the aid of diagram, describe the maxillary 1st molar.
4. What is the distinguishing feature of mandibular 1st molar?

7.0 REFERENCES/FURTHER READING

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UNIT 6 FUNCTIONS OF THE VARIOUS TEETH IN THE MOUTH

CONTENTS

1.0 INTRODUCTION

Teeth as we know are a set of organs or structures of human being found in the mouth. Their presence in the mouth is for certain reasons and functions. Each tooth therefore has particular functions they perform in maintaining the structure of the face, health condition of the mouth, mastication and digestion of food and speech.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- state the basic functions of individual tooth and collective functions of the entire teeth
- discuss the positions and alignment of the various teeth in the mouth
- enumerate the effects of absence of any tooth in the mouth.

3.0 MAIN CONTENT

3.1 General Functions of Teeth

The basic functions of teeth are to prepare food for deglutition and to facilitate digestion of such food. Teeth help in the maintenance of good health of other oral structures. They help in maintaining the integrity of the mouth and face and in speech making.

The teeth prepare food for deglutition by the action of the anterior teeth which cut, grasp and tear such food. The posterior teeth perform the

crushing and grinding action thereby preparing the food in such a condition that is ready for swallowing. Non mastication of food which requires mastication contributes to indigestion. It is therefore very important that foods are chewed adequately to get them ready for proper digestion.

Teeth contours are designed as to help in the deflection of food particles away from underlying tissues. This protects the tissues from being impinged upon by food particles. These tissues are also protected by the shape of teeth to avoid stagnation of food debris in-between the teeth which can cause decay or set in other pathology.

The teeth maintain the integrity of the mouth and face by their various positions in the mouth. They do this by supporting the cheek and lip muscles as well as forming corners of the mouth, thus ensuring aesthetics. Without proper support, the facial muscles will contract and hamper functions; the facial profile which ensures good appearance will alter. These teeth which align help ensure that the tissues of the cheeks and lips are not torn upon the closure or contact of opposing teeth.

The teeth play vital role in phonetics (speech). Sounds are created by either obstruction or shaping of breath. The other organs which contribute to this are the lips, tongue, alveolar ridge, hard and soft palates. All these have direct relationship or bearing with the teeth to ensure production of the required sound or pronunciation. Sounds such as vowels are made by free passage of air through the various organs responsible. Consonants are made by closure or contact of certain organs of the mouth which have direct bearing with the teeth. Loss of teeth therefore affects these functions enumerated above which the teeth directly or indirectly carryout.

3.2 Functions of Individual Tooth and the Different Classes of Teeth

Anterior teeth are designed for cutting or incising and holding. They act as shears or scissors when they come into contact with opposing teeth. They are also very important in aesthetics and speech.

The posterior teeth are also designed for crushing and grinding using their multi cusped occlusal surfaces when the opposing teeth come into contact. They assist in aesthetics especially when visible to the eyes.

Central incisor: This is for incising or cutting; supports the lip filtrum and is the personality tooth. Very important in aesthetics and speech for sounds such as F, S, V, ph.

Lateral incisor: For incising and lip support. Supports the central incisor in the performance of functions of aesthetics and speech.

Canine: For incising, grasping, tearing and holding. Considered the cornerstone of the arch because it provides the transition between the incisors and posteriors. Forms the corners of the mouth and supports the lips at such corners.

First (1st) premolar: This is the transition tooth between anteriors and posteriors. Used in crushing and grinding but can also assist in incising, grasping and holding. It is important in the production of sounds such as "sh" and "th" especially in prostheses. It also assists aesthetics when visible to the eyes.

Second (2nd) premolar: Similar to 1st premolar but more effective in crushing and grinding.

First (1st) molar: For crushing and grinding. Forms the pillar of the arch and is strong abutment for removable partial dentures as well as bridges. This is because of their strong root structure as well as their wide occlusal table.

Second (2nd) molar: Similar to first (1st) molar.

4.0 CONCLUSION

In this unit, you have learnt about the functions of teeth in mouth. These functions are maintenance of the mouth in good health, maintenance of the facial structure thereby keeping the aesthetics of individuals. The teeth also prepare food for deglutition and digestion. They also play vital roles in enunciating or pronunciation of speech.

5.0 SUMMARY

This unit has taught us about the basic functions of collective and individual teeth. It has also taught us the effect of positions and alignment of the various teeth in the mouth as well as the effects of absence of any of the teeth in the mouth.

6.0 TUTOR-MARKED ASSIGNMENT

1. What are the basic functions of anterior teeth?
2. What class of teeth primarily affects speech and creation of sounds?
3. Why is the first (1st) molar referred to as pillar of the arch?

7.0 REFERENCES/FURTHER READING

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MODULE 3 MODEL-MAKING IN DENTAL TECHNOLOGY

UNIT 1 CONCEPT OF IMPRESSION- TAKING

CONTENTS

1.0 INTRODUCTION

In order to perform the major duties of dental technology, an accurate reproduction of the given part of human body on which such replacement or prosthesis is to be placed upon is very essential. This stems from the fact that, the construction of appliances for patients are not done directly in the patients mouth. Rather, such appliances are constructed on an exact replica of such organ (models) and later inserted or fitted on the patients. Therefore to obtain such exact replica of patient's organ on which appliances are constructed, an impression of same is obtained.

Impressions as obtained are classified into different categories and with different materials also. These categories and materials will be discussed in this unit.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain impression and its aims
- discuss materials available for the taking of impression

- enumerate what ideals are expected of an impression
- classify impression materials and types of impression.

3.0 MAIN CONTENT

3.1 What is Impression and Impression- Taking?

Impression is the negative likeness of a given area of the oral, dentofacial or cranio-facial site. They are like the negatives in photography from which the actual pictures are made. It is from impression that models, on which designing and construction of appliances are made. In the process of impression taking, a lot of factors come to play. These factors range from position of patient and operator, the types of materials used and the tray used in obtaining the impression. During impression taking, it is advisable that the patient sits in upright position to avoid the head bending backwards. This is to ensure comfort of the patient as well as avoiding chocking of patient if there is breakage of impression material in the course of the procedure. The operator is to stay on a particular position that will make for comfort as well as see the procedures clearly without hindrance.

Impression trays are the rigid metallic or non metallic implement with which impression materials are carried into the mouth. They serve to support the material and maintain it in position during setting and removal from the mouth, and pouring the cast (model making).

Impression trays are either stock or special and are either perforated or unperforated. The stock trays are the pre manufactured trays in a variety of sizes and shapes. They are either metallic or metallic. The metallic ones are rigid and strong. They are reusable upon sterilisation. The non metallic ones (plastics) are not as strong as the metallic ones and are disposable as they are not intended to be reused. They are perforated or unperforated, in which case, retention of impression is by the application of fixative on the inner wall of the tray. Stock trays are generally used for preliminary impression.

Special trays are the laboratory made trays which are specifically made for a particular jaw or patient to ensure obtaining of a close fitting impression. It is customised as it cannot be used for separate patients. They are either perforated or unperforated. They are used for master impression.

3.2 Materials for Impression Taking and Classification

As stated previously, before the construction of any appliance is done, it is necessary to obtain the exact replica of the patient's oral, dentofacial or crani-facial site on which the appliance is originally constructed. These exact replicas are made from the negative likeness which is the impression. Materials for obtaining the negative likeness are referred to as impression materials.

The materials which exhibit more fluidity and high level of flow hardly displace tissues are referred to as "mocostatic impression." This is because they record the impression while the tissues remain static, as against the less fluid materials which compress the tissues during the recording of impression. These are referred to as "muco compressive impression."

Impression materials are classified in various ways ranging from those that set as a result of a chemical reaction to those that set as a result of change in temperature or based on their flexibility during removal from the mouth. For the purpose of this write-up, our classification will be based on the flexibility of materials during removal from the mouth.

Dental impression materials are classified as rigid (inelastic) or flexible (elastic) impression materials.

The rigid impression materials are non elastic and cannot exhibit springing quality upon deformation. They do not exhibit flexibility as any deformation produces a permanent change in shape. They are not used in an undercut area as they tear or permanently deform on removal from such undercut area. They are used for impression of edentulous mouth or tooth prepared for full crown since no undercut is present.

The elastic impressions materials are flexible in nature and are capable of springing out of an undercut area and return to its shape without any kind of change in shape. They can be bent or stretched to certain extent without permanent deformation or change in shape. They are used for the impression of both dentulous and edentulous cases. They can come out of undercut areas without change in shape. This explains why materials under this category are more frequently used, presently.

Table 1.1: Classification of Impression Materials

Rigid (inelastic)	Flexible (elastic)
Impression compound (Compo)	Hydro colloids - Agar (reversible hydrocolloid)
Impression plaster	- Alginate (irreversible hydrocolloid)
Zinc-Oxide–Eugenol (ZOE)	Elastomers
Impression waxes	Polysulfide rubber Silicone (Condensation silicone) Polyether rubber Addition silicone (polyvinilsiloxanes)

The above materials, it is hoped, will be discussed in details in dental materials course of this programme.

3.3 Requirements of Good Impression Materials

Impression materials are expected to fulfill certain requirements to be certified fit for use in dentistry.

These requirements are:

- Ease of manipulative and pocket friendly.
- Accurate recording of the required area: Must exhibit enough flow property on insertion in the oral or orofacial site and record fine details with negligible dimensional change.
- Must exhibit sufficient strength not to tear or deform permanently on removal from the mouth.
- Must be non toxic, non irritant to the tissue- ensuring safety with acceptable or non repulsive odour.
- Must be compatible with model and die materials.
- Must exhibit colour contrast with model material for ease of distinguishing.
- Must be of suitable working time to allow for placement in the mouth and setting time to avoid undue time length in the mouth; should not exceed five (5) minutes in the mouth.
- Must have good shelf life.

From the above, it is seen that many requirements are placed on impression materials. No single impression material in use today fulfils, completely, all these requirements.

4.0 CONCLUSION

In this unit, you learnt the rudiments of impression taking, impression materials and categorisation. You have also learnt the ideal requirements of impression materials.

5.0 SUMMARY

You have learnt what impression means and what the aims are. You also learnt about the materials available for impression taking and their classifications. The implements and positions expected of patients and practitioners to take during the procedure. You have also learnt about the ideal requirements expected of good impression materials.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define impression and categorise dental impression materials.
2. Materials/implements used in carrying impression into the mouth are of different categories. Discuss.
3. List and explain three ideal qualities/requirements of a good impression material.

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UNIT 2 IMPRESSION HANDLING AND CASTING TECHNIQUES

CONTENTS

1.0 INTRODUCTION

Accurate reproduction of an impression is very essential for the production of a good fitting and comfortable appliance for patient's use. It is also a starting point for any procedure in restorative or prosthetic dentistry. It is therefore instructive that making a model should follow a standardised procedure with adequate care and handling to ensure that a good result is achieved. Prior to and during production of a model, all impressions must be handled with utmost care to avoid damage or distortion which, will jeopardise the end result.

The aim of proper handling of impression therefore is to:

1. Ensure that all areas/features required in the impression appear.
2. Ensure that the impression is neither dragged nor distorted during removal from the oral, dentofacial or cranio-facial site.
3. To prevent infection by the practitioner.
4. To prevent cross infection from one patient to another in the course of construction procedures with the practitioner acting as a medium for such cross infection.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- outline the procedures for care and handling of an impression
- discuss casting of an impression made of different materials
- outline the requirements of a good model
- explain the implications and consequences of using poor cast/model in design and construction of appliances.

3.0 MAIN CONTENT

3.1 Concept of Impression Handling and Casting

This is the procedure of producing a positive likeness of a given area of oral, oro-facial or cranio- facial site. It is on this produced positive likeness (model) that designing and construction of prostheses/appliances are made: This procedure is the first procedure/step in the construction of every appliance.

Models are of different kinds and for different purposes viz. (i) Preliminary (ii) Diagnostic (iii) Preoperative (iv) Master (v) Pinned (vi) Orthodontic.

Model production is the first step in the construction of any prosthesis. Proper handling of the impression is of necessity in ensuring the achievement of desired result. This is because any distortion or damage can lead to poor or clinically unacceptable prosthesis.

In order to ensure proper handling of impression, the following steps are undertaken:

a. Inspect the impression upon removal from the cavity or site to ensure that all associated features or tissue anatomy required appear and that no distortion or drag is on the surface of the impression.
b. Rinse impression under slow running cold tap water to eliminate blood mucous, saliva and other mouth debris.
c. Remove excess moisture with a gentle stream of air blown over the impression surface (do not use strong air blast and do not over dry the impression surface).
d. Suspend the impression by the handle or place slanted with the posterior borders elevated to prevent the possibility of any distortion resulting from pressure being placed on the impression especially the unsupported extension ready for casting.

Casting is the filling of an impression with appropriate model material to the periphery. This is achieved by vibrating the material into the impression to ensure its consolidation, devoid of air bubbles and good strength to withstand laboratory stresses. For a satisfactory or good cast to be obtained, it is essential that the impression received is handled properly and filled with model materials immediately.

3.2 Rationale for Impression Handling

Properly handled and poured impression represents a major milestone for any procedure in restorative or prosthetic dentistry. This is because prostheses are not made in the patients' mouth but on an object which represents the mouth in its accurate shape and features.

All impressions must be handled with utmost care to avoid any form of damage or distortion. Impressions are prone to damage or distortion at the periphery or if left to stand for a long period of time thereby causing water loss. Faulty impression will result in unacceptable cast which, if utilised as such, result in clinically unacceptable prostheses. It is therefore absolutely important that impressions are handled properly following the ideal procedures or the manufacturer's instruction for optimum result. Hydrocolloid impressions should be protected by placing a wet dental napkin or well cotton wool over them to prevent drying out and distortion of the impression.

Impressions with peripheral or posterior border extension beyond the trays should not be placed over a hard object where these extensions will be affected by any form of pressure.

3.3 Methods of Handling Gypsum Products

Gypsum products remain of one of the most important pillars of the dental technology field. It continues to be the material of choice for model making, investment mould and a constituent of certain refractory investment materials. Like every other available material in use in dental technology, handling of gypsum product must follow a highly standardised procedure in order to maximise its positive qualities.

Various methods exist by which the products are handled. Irrespective of the method applied in handling gypsum product, certain factors remain common to all of them. These factors are:

- Mixing bowl and spatula must be clean and devoid of any debris.
- Mixing ratio, as recommended by manufacturer, must be adhered to.

- Mixing water should be at room temperature and distilled or demineralised. This is because tap water varies in temperature, water hardness and quality. Tap water contains minerals like sulphates, carbonates and chlorides which affect the crystalline conversion of subhydrate to dehydrate. This in turn affects the quality of the gypsum products.

The various methods available for the handling of gypsum products are manual spatulation and mechanical/vacuum mixing.

3.3.1 Manual Spatulation Method

This method is a situation where the materials are sifted into an already measured water in a mixing bowl and spatulating it manually.

Procedures:

i. Measure out the standard quantity of water, as recommended by manufacturer of the gypsum product, into a thoroughly clean bowl.
ii. Measure out the required amount of gypsum product.
iii. Add the gypsum product by gradually sifting into the water slowly.
iv. Allow to saturate for about 20-30 seconds.
v. Stir slowly avoiding whipping action. This is to prevent trapping of air.
vi. When the material is properly mixed, it is vibrated into the impression. Place the impression on the mechanical vibrator in upright position, that is, with the posterior border of the impression elevated. Keep placing small amount of the materials in the second molar (posterior region) and allow to flow into all parts of the impression.
vii. Turn the impression, replace it on the vibrator and allow excess materials to flow out into the mixing bowl.
viii. Vibrate more material into the impression again so that it is completely filled. Remove the impression from the vibrator and place it in a slanted position with the posterior border elevated. Alternatively, suspend the impression by the handle. The essence is to prevent the possibility of any distortion resulting from pressure being placed on the impression especially the unsupported extension.

The essence of vibration is to eliminate air bubbles from the materials, to ensure consolidation and good strength of model capable of withstanding laboratory process or pressure.

3.3.2 Mechanical /Vacuum Mixer

Without doubt or fear of contradiction, this is the best way to process gypsum product, so far. Though, this method is sometimes not within the reach of most practitioners within this part of the world due to financial implications. Using this method offers a more accurate measurement of the materials involved (water to powder) as well as producing a better finished material. This is because most mechanical mixers have one or more mixing speeds and length of mixing time referred to revolutions per minute (RPM) to choose from. By this choice, control of the exact number of rotations used in mixing the material is adequately effected.

Procedure:

i. Using a clean mixing bowl, measure out the recommended quantity of water.
ii. Measure out the recommended quantity of gypsum product (powder).
iii. Gradually add the powder by gently sifting into the water slowly. This is to ensure that lumpy mixture with large volume of air bubbles are not enclosed in the mix. Allow for about 20-30 seconds for saturation.
iv. Spatulate slowly to incorporate all powders.
v. Transfer the mixing bowl to the vacuum mixer.
a. Switch on the vacuum pump to build up enough vacuum pressure in the bowl.
b. Start the mixing circle to mix the materials to normal consistency and remove the bowl.
c. Vibrate to eliminate air bubbles and then proceed to fill the impression. Suspend or slant filled impression in upright position.

Precautions to note:

i. Ensure that complete or full air vacuum is achieved before mixing circle starts to avoid introduction of air into the materials. This is to make sure that various ranges of air bubble which will eventually weaken the model are not introduced.
ii. Ensure that pressure in the mixing bowl is neither too high nor low. If the pressure is too low, the water may bring to boil at room temperature. If this occurs, the model will be full of micro bubbles resulting in low density and strength of model produced. If too high, pressure is produced, it will also produce a set beck.

Therefore, if too high pressure is in the mixing bowl, evacuate the air from the gypsum product under maximum pressure for about

20 seconds and start again. With the above in mind, ensure that all mixer settings or calibrations are in good order before processing with the machine.

iii. Never leave the bowl of mixed materials on the vibrator while filling the impression.

iv. Pour the gypsum product into mould (impression) in the shortest possible time while vibrating it gently.

3.4 Armamentum and Methods of Casting

There are basic requirements that are needed for casting of impression to take place. These are materials and instruments that are strictly required to be available for proper job to be done. They are:

1. Impression(s)
2. Gypsum product (Artificial Stone/Model Material)
3. Distilled or de-mineralised water
4. Mixing bowl and spatula
5. Laboratory plaster knife and chisel
6. Mechanical vibrator
7. Suspender or tray holder or elevator
8. Boxing wax; metal strip or caulking compound.
9. Glass slab.

Casting of an impression in based on the impression materials used. There are basically two (2) methods of casting impression or making models ready for further processing. These are:

i. Inverted or “basing – off” method
ii. Boxing-in method.

3.4.1 Inverted or Basing –off Method

This is a method of casting impression where by the impression is filled with model material and upon setting of the model material; the filled impression is inverted on mass of same or different material to form the base.

This method can apply for all impression materials irrespective of its nature.

Procedure:

i. Upon receipt of impression, inspect for accuracy and all surface details devoid of drag or distortion.

ii. Rinse in a slow running tap/cold water to remove every trace of saliva, debris or blood stains as the case maybe. Remove excess water by gently blowing the impression with compressed air, but do not over dry the impression surface.
iii. Suspend or slant the impression with the posterior border elevated to avoid undue pressure on it especially the unsupported extension of impression.
iv. Select a suitable, clean mixing blow and spatula.
v. Measure out the required materials (de-mineralised water and gypsum product) according to manufacturer's recommendation.
vi. With the water in the mixing bowl, gently sift the gypsum product into it and allow to saturate (20-30seconds)
vii. Mix the materials with the spatula to an appropriate consistency. (This takes approximately 30seconds). The product (mix) is ready for use.
viii. Fill the impression with the materials while vibrating to eliminate air bubbles. Place the impression on the mechanical vibrator and flow the materials into it through the elevated posterior region. Turn the impression to allow excess materials to flow back into the mixing bowl. (This is to ensure surface details being covered with casting /model material).
ix. Turn the impression, the posterior border elevated, on the vibrator again and fill the entire impression
x. Remove the filled impression and place it on a suspender, tray holder or elevator in an upright position. Allow to reach the initial setting.
xi. Place the remaining material on a glass slab or a new mixture can be made and the filled impression inverted onto the mass of material.
xii. Using the plaster knife, shape the cast appropriately and allow to set, finally. This occurs at about 30-40 minutes, depending on the manufacturer's specification and the level of manipulation by the dental technologist.

Note: The method describe above is manual speculation.

If mechanical vacuum mixed is desired, the procedure as enumerated in 3.3.2 is used.

3.4.2 Boxing-in Method

This is the process of building wax or boxing-in materials around the periphery of an impression to such a height that will form the base of the cast, preserve landmarks of impression and reduce trimming to the bearest minimum. Not all impressions can be boxed-in and it is better to cast such impressions without boxing. Example of such is alginate

impressions. Due to the water content, boxing materials hardly adhere to it; and due to time taken to attach the boxing material, distortion and dimensional change occur due to water loss to the environment. Materials available for boxing in impressions are wax, caulking compound, metal strips.

Procedure:

i. Upon receipt of impression, inspect to ensure that there is no drag or distortion on the surface and that the required features are present.
ii. Rinse in a slow running tap/cold water to remove every trace of saliva, debris or blood stains as the case maybe. Remove excess water by gently blowing the impression with compressed air, but do not over dry the impression surface.
iii. Place the impression on a bench with the surface facing up. Attach a strip of boxing materials just below the periphery of the impression to about 13mm height above the highest point of the impression.

    For mandibular impression, fill the tongue space by using sheet of base plate or model wax and sealing it properly at about 3-4mm below the border of the impression.
iv. Treat the impression adequately as recommended.
v. Select suitable, clean mixing bowl and spatula.
vi. Measure out the required materials (de-mineralised water and gypsum product into it and allow to saturate (20-30 seconds).
vii. With the water in the mixing bowl, gently sift the gypsum product into it and allow to saturate (20-30seconds).
viii. Mix the material with the spatula to an appropriate consistency. (This takes approximately 30 seconds). The product (mix) is ready for use.
ix. Fill the impression with the materials while vibrating to eliminate air bubbles. Place the impression on the mechanical vibrator and flow the materials into it through the elevated posterior region. Turn the impression to allow excess materials to flow back into the mixing bowl. (This is to ensure surface details being covered with casting/model material).
x. Turn the impression, the posterior border elevated, on the vibrator again and fill the entire impression.
xi. Remove the filled impression and place it on a suspender, or tray holder and allow to set.

This setting takes about 30-40 minutes, depending on manufacturer's specification and level of manipulating by the Dental Technologist.

Note: The method describe above is manual spatulation.

If mechanical vacuum mixed is desired the procedure as enumerated in 3.3.2 are used.

Precautions:

i. Make sure that the boxing wax or materials is not too thin (should be about 4mm wide) as vibrations can impact it negatively.
ii. Ensure that the boxing materials are adequately sealed to the impression at about 3-4mm below the border of impression.
iii. Ensure that the height of boxing materials is neither too high nor too low on impression. Keep it about 13mm above impression.
iv. Ensure that the impression is not lopsided prior to or during boxing. Ensure parallelism.

3.5 Requirements of a Good Cast/Model

A good model is expected to posses certain qualities which enable production of clinically accepted prosthesis, all things being equal.

These qualities are:

1. The surface of a model should be hard, dense and free from any of trimming sludge or mud. Possess sufficient strength to withstand Laboratory stress.
2. The tongue space, mandibular model, should be flat and smooth when trimmed but the lingual peripheral roll should be intact.
3. Should not show any sign of being wet or washed with de-mineralised water.
4. Should extend to include all area available for denture/ appliance support.
5. Should show accurate reproduction of all details of the impression (intra oral anatomy)
6. Sides of cast should be vertical or slightly tapered outwards.

Deviation from these qualities renders produced prosthesis or appliance clinically unacceptable.

4.0 CONCLUSION

In the unit, we have learnt the concept of impression handling and casting. We have also learnt the rationale for proper handling of impression; various methods of handling gypsum product namely manual **spatulation** and mechanical/vacuum mixer. We have also studied the various armamentum and methods of casting impressions

which are inverted or basing off and boxing-in methods. This unit has also taught us the qualities required of a good cast or model so as to achieve optimum result in the construction of prosthesis.

5.0 SUMMARY

In this unit, we have been acquainted with the knowledge of the procedures for the care and handling of impression. We have also learnt how to cast impression made from different materials and the various ways of making models in order to obtain good results.

6.0 TUTOR-MARKED ASSIGNMENT

1. What are the precautionary measures to adopt when boxing-in an impression?
2. Various methods of handling gypsum products exist and these methods are influenced by certain factors. Discuss the common factors to these methods?
3. Discuss the procedure for using manual spatulation method in casting an impression.

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UNIT 3 MODEL SEPARATION AND TRIMMING TECHNIQUES

CONTENTS

1.0 INTRODUCTION

Design and fabrication of prosthesis are done on models as against being done in patients' mouth. For these to take place, the model obtained from the impression must be separated. This is to enable processes to be carried out from all sides or aspects of the jaw which the model represents.

Following the separation of model from impression, they are trimmed to enable the expected portions of the dental technologist who will carry out the functions of design and fabrication of prosthesis on them.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- describe various ways of separating models obtained from different impression materials

- explain what model trimming is all about
- describe the different ways of trimming a model
- enumerate the various requirements or ideal properties of well trimmed model.

3.0 MAIN CONTENT

3.1 General Concept of Model Separation

Model separation is a planned sequential means of obtaining a model from a cast impression after it has reached the final set. This is accomplished by the withdrawal of the cast from the impression so as to prevent dehydration of the impression and undue attachment and hardening between the two materials.

Usually the compositions of impression materials and model materials are quite distinct and do not usually unite together except in few instances such as impression plaster. In such situations, the surfaces of the impression are treated adequately with a separating medium to prevent chemical union between the two materials.

Separation of models from impression takes different ways depending on the nature of impression material used. This is because while model materials are virtually material of the same chemical composition, impression materials differ greatly. It is therefore imperative that these impression materials upon which models are cast are treated on individual bases depending on their makeup.

3.2 Separation of Model from Different (Individual) Impression Materials

3.2.1 Separation of Model from Compound Impression Material

Following the final set of model, it is separated from compound impression by simply immersing the mass in hot water (50-60^{o}C) for about 30-45seconds. Because compound impression material is a thermoplastic material, it becomes soft and it's gently separated from both tray and model. A good sequence is to first separate the tray from the impression and then the buccal aspect of the impression, all rounds, lifted away from the model. This is followed by the lifting of the lingual and palatal aspects, as the case maybe.

Care should be taken to ensure that the material does not pull off part of the model especially due to non proper softening of the compound

impression. Over heating can cause pieces of the materials to stick to the surface of model. This can be removed by pressing a mass of softened compound impression on to them.

3.2.2 Separation of Model from Zinc Oxide Eugenol Impression (ZOE)

Once the model has reached final set, a stream of boiling water is used to soften the impression material. The mass can be immersed in boiling water for about 5-10 minutes to soften the material and loosen it. It is subsequently chipped away from the model by sectioning. Remaining traces of ZOE can be removed with turpentine (solvent for ZOE).

3.2.3 Separation of Model from Impression Plaster

Upon setting of the model, the impression plaster is gently chipped off using plaster knife. This is possible because before the cast of model, the impression surface is usually treated with separating medium.

Use of hot water is also advantageous as it makes the impression to swell and come off the model. This is possible because impression plaster contains starch which makes the materials to swell when poured hot water. Care must be exercised to ensure that the model is not adversely affected by hot water as boiling water often damage models due to the differences in the temperature; the surface of model can become hot while the inside in cool. This temperature disparity often causes the model to fracture.

3.2.4 Separation of Model from Alginate Impression

This is probably one of the easiest and most convenient of model separation as it does not involve the use or application of any other material. It is separated by gently tapping the handle of the tray with a plaster knife upon set of model for the model to come off the impression. Alternatively, the tray is first separated and the alginate lifted from the buccal and labial sides of the model with fingers.

It is advisable to separate the model immediately it sets to prevent dehydration of impression and subsequent shrinkage and sticking of impression on the model as well as surface roughness.

3.2.5 Separation of Model from Silicone/Rubber Base Impression

Just like the ZOE, silicone/rubber base impression is separated by immersing it in hot water for about 5-10 minutes to loosen it. It is

subsequently pulled away from the model by gentle lifting. If adequate care is taken, silicone/rubber impression can be used to produce as many models as possible before it is discarded.

3.3 Concept of Model Trimming

Every model or cast, upon setting, ought to have definite shape which reflects the intraoral tissues. All inconsistencies and surface modules should be eliminated so as to enable proper articulation of opposing jaws and pleasant appearance.

Trimming therefore is the act or process of shaping a model to a desired shape without necessity cutting into the anatomical features. The walls of maxillary and mandibular models have definite shapes and number, therefore necessitating their shaping to reflect these. The walls are about 5mm away from the peripheral border of anatomical features. This is to enable protection of these features else prostheses constructed on them will not be correct.

It is therefore advisable that models be trimmed immediately after it has become hard. This can be achieved by the use of model trimming machine. There are basically two (2) methods of trimming viz. (i) Wet Trimming and (ii) Dry Trimming.

3.3.1 Wet Trimming

Wet trimming is the method of shaping a model to the desired size and number of sides. This is done before the final set of model. This method works fast and does not require great effort. The only set back is the trimming sludge or mud which settles on the model surface. However, this is remedied by ensuring thorough wetting of the model before the commencement of trimming. It is advisable also to spray the model with an insulator which helps to protect the model from mud spray. The types of insulator should be such that penetrates the pores of the model material leaving no visible film on the surface. This is kept until the model work is finished to ensure protection of the cast especially the preparation and anatomical features /margins.

3.3.2 Dry Trimming

This method has been in practice and successful too. It is done without wetting or use of water. The only drawback is the long period that the model will wait for final set to take place before trimming is done, a minimum of two (2) hours- preferably over night. Dry trimming produces considerable noise as well as airborne dust, even in the presence of suction.

Time wastage can be remedied by the use of microwave to dry the model after about 20-30 minutes of air drying without the physical properties being affected, negatively.

3.4 Requirements of a Trimmed Model

The following are the requirements of a trimmed model:

1. The base of the model must be flat and level side to side
2. The model should be slightly higher anteriorly
3. It should taper slightly to the base
4. All sides must be smooth
5. Lower models must be rounded
6. Upper models must show the margins of the mouth viz. midline, corners of the mouth- Indicated by canine positions
7. Must not be trimmed into the anatomical features e.g. sulcus, muscles attachments, retromolar pad.

4.0 CONCLUSION

In this unit, you have learnt about the broad concept of model separation. You have also looked at the ways of separating model from the impression of different materials including compound impression, zinc oxide eugenol, impression plaster, alginate impression and silicone/rubber base impression.

You have also learnt about the concept of model trimming and the different approaches to it viz. wet trimming and dry trimming. The ideal requirements of a trimmed model have also been learnt.

5.0 SUMMARY

In this unit, you have established the various ways of separating models made from different impression materials. You have also learnt what model trimming is all about, which is the act of shaping a model to a desired shape without cutting into the anatomical features. The unit taught also the various ways of model trimming-wet and dry trimming as well as the basic requirements of a well trimmed model.

6.0 TUTOR-MARKED ASSIGNMENT

1. Briefly describe the separation of model from compound impression.
2. Why do you have to separate cast from alginate impression as soon as it sets?
3. Describe the concept of wet trimming.

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UNIT 4 MODEL DUPLICATION: CONCEPT AND TECHNIQUES

CONTENTS

1.0 INTRODUCTION

It is not usually appropriate for model used in the fabrication of dental appliance to be destroyed in the process; the model is expected to remain intact. Achieving this feat is usually a herculean task and most times impossible. This is as a result of the fact that both flasking materials, plaster of Paris and the model material, artificial stone, are materials of the same chemical composition; they unite in the process thereby making their separation, without tempering with the model difficult and impossible, most times.

Due to this difficulty, it therefore becomes very imperative for the model to be duplicated to enable check for fit without danger of abrading or fracturing the surface of original cast.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- discuss duplication
- enumerate reasons for duplication of models
- itemise the reasons why duplicate of model must be an accurate reproduction

- explain why every impression materials can be used for duplication of models.

3.0 MAIN CONTENT

3.1 Conceptualisation of Model Duplication

Duplication is the act of reproducing another model from the original or master cast, accurately.

Duplicate model must be an accurate reproduction of the master cast and as such, care must be taken to ensure accuracy, else prosthesis made from or with such duplicate will fail to fit or fulfill its functions and purpose.

All impression materials can be used for duplication of models; since duplication entails making an imprint of the master cast on such impression material and pouring model material into it, just like impression materials are mixed and carried into the oral cavity to record the required area.

3.2 Rationale for Duplication of Model

Duplicate models are required for the construction of various appliances including complete and partial dentures. Duplication maybe done for varieties of other reason ranging from:

a). For processing of dental appliances so that finished prosthesis maybe fitted on master cast during trimming and finishing process. This saves surgery time.
b). For metal works- the duplicate is made in refractory investment materials.
c). As a reference model by dental boards and as in orthodontic treatment.
d). For the purpose of studies –Students use.

If models are not duplicated, any deviation or alteration on its surface during processing makes it difficult, if not impossible, to check for the fit of such appliance constructed on it.

3.3 Duplication of Model using Different Materials

3.3.1 Duplication of Model using Alginate Impression Material

Alginate is an irreversible hydrocolloid impression material and therefore its use is only once. The procedures for its use involve the use of stock tray.

Alginate materials is mixed as usual, loaded in the tray and the already soaked model seated and gently pressed in, just like the usual impression taking.

Upon setting of the alginate, the model is withdrawn. The surface of the impression made is washed under slow running water. The tray is suspended as usual. The model material is mixed and poured as usual while vibrating to eliminate air bubble. In a nutshell, once the imprint has been gotten, the procedure for impression casting is subsequently followed. The method of separation of model also remains the same. The major disadvantage of this method is that sometimes, the impression material pulls out of tray and accurate replacement becomes impossible.

3.3.2 Duplication of Model using Compound Impression Material

As usual, the material is softened using hot water and kneaded to required consistency. It is loaded on the stock tray and the surface treated with separating medium such as petroleum Jelly to prevent sticking of the material on the model. The soaked model is gently seated on the tray for the imprint to be obtained. The material is not allowed to harden before the withdrawal of the model. If allowed to harden completely, separation becomes difficult thereby rendering the process null and void as hot water soaking of both materials and tray will be required to separate them.

Subsequent upon separation, the surface of impression is passed under slow running cold water to remove any form of debris on the surface. The model material is then mixed and poured as usual, while vibrating to eliminate air bubbles. Upon setting, the duplicate is separated from the impression by soaking in a hot water for some moments to soften the impression compound and they are pulled away from the model by gently lifting it away from the buccal and labial sides and then the palatal or lingual area. In this way, fracture of teeth is avoided. If pieces of compound adhere to the model, they are removed by pressing softened material on to them. In short, once the imprint of the master/original model is obtained, pouring and separation of the cast are

handled the same way as it is in impression casting and separation earlier treated in previous unit.

3.3.3 Duplication of Model using Agar-Agar Impression Material

Agar-agar is an elastic impression materials and it falls under the category of reversible hydrocolloid. It is thermoplastic, which means that when heated or when the temperature surrounding the material is raised, it becomes fluid and the molecules move freely. At this stage, the materials is said to be in "sol" state. With decrease or reduction in temperature, the materials joins together to form jelly-like mass or network of fibrils. This jelly-like mass formed is termed "gel" state. The greater the concentration of fibrils, the tougher the gel.

By increase in temperature, the material is changed to "sol" state and decrease or reduction in temperature leads to the solidification of the material hence "gel state." Due to this repeated change from "gel" to "sol" and vice versa, as a result of corresponding change in temperature, the term reversible hydrocolloid is applied. The material melts completely to "sol" state at a temperature between 99^oC- 104^oC and solidifies to "gel" state at 50^oC -55^oC. Therefore, this temperature and time lag between the cooling of reversible hydrocolloid form "sol" to "gel" is termed HYSTERESIS.

Procedures for duplication using agar-agar:

i) Survey the model to be duplicated and block out all unfavourable undercuts. Create a post dam if the model is upper. Support all venerable teeth if the model is dentate.
ii) Prepare duplicating flask ensuring cleanliness and proper fitting of the components of flask.
iii) Cut the required quantity of agar into the melting machine ensuring that all buttons and calibrations on the machine are in their correct order before switching on the machine. Stir the material at intervals to ensure uniformity.
iv) Soak model in water at room temperature for saturation to take place to avoid the model attracting or drawing water from the duplicating material.
v) Upon complete melting of the material (sol state) at 100^oC, the machine is switched off and the material allowed to drop in temperature to about 65^oC.
vi) Place the model on the base of the duplicating flask using plasticine to hold it firmly in position. Cover the flask in a sealed position to avoid leakage of material.

vii) Pour the 'sol' through the opening on the top of the flask until the material appears on the other opening (full).
viii) Allow the material to 'gel' on cooling (for faster gelation, the flask can be placed on a cooling machine).
ix) Upon complete gelation, the flask is inverted and opened through the base and the model separated by inserting a pointed instrument into the sides of the model and gently lifted out of place.
x) Swill the surface of the mould formed with alum solution (fixing solution).
xi) Mix an appropriate consistency of model material and pour into the mould using the proper way of handling model material and vibrating to eliminate air bubbles.
xii) Separate the duplicate on complete setting by inserting a pointed instrument into the sides of the duplicate and gentle lifting it out of place.

Further models can be poured again as long as distortion and tear do not occur on the mould.

Agar-agar can be used severally provided no contamination with debris has taken place. New materials can be added to give elasticity and strength to severally reused material

Advantages:

- Several re-use of material before discarding.
- Has high strength and elastic properties, and records undercuts satisfactorily.

Disadvantages:

- Subject to dimensional change, if stored in open air or water - syneresis or imbibitions respectively will take place.
- Accompanying syneresis or hydrolysis is loss of elasticity and strength properties.

Syneresis: Shrinkage or reduction in size (dimensional change) due to exudation or elimination of water molecules from the surface of hydrocolloid impression material as a result of exposure to dry atmosphere.
Imbibition: Increase in the dimension of hydrocolloid impression as a result of absorption or intake of water molecules from external source.

3.3.4 Materials for Duplicating of Multiple Models

When several models are required to be made such as during students' practice or examination since they are required to be judged based on same principles and standard, materials which are much stronger than ordinary duplicators are required so that they can withstand the laboratory stress in extracting the models. These materials are Latex, Vinamould, soft vulcanized rubber and polyvinyl chloride (PVC).

Procedure for mould preparation:

Latex: The model to be duplicated is covered with about four (4) layers of modeling wax to form the imprint. The wax is used as impression material to get the details of the model. Form sprue, for pouring of the Latex material, through the posterior border of model, adjoining the four (4) layers of modeling wax.

Invest the assembly in a plaster and top subsequently as usual. Allow to set and subject the plaster mould to hot water for the usual elimination of wax (boiling out).

Sequel to boiling out, do not allow the mould to dry and then pour the liquid Latex into the saturated mould. Allow to cure at room temperature or place in low temperature furnace for speedy curing.

On complete cure of Latex, the material becomes coagulated into a flexible mass. Separate Latex from the mould and trim off excess material (sprue). On the recovered Latex which bears the negative likeness of the model being duplicated, the duplicates are poured. Several duplicates can be made from the Latex. Other materials for multiple duplication of models are soft vulcanising rubber and vinamould.

4.0 CONCLUSION

In this unit, you learnt the concept of model duplication and the rationale for the exercise. The various materials for duplication have been dealt with also. These materials range from alginate impression material, compound impression material as well as agar-agar. The unit has also taught us the various materials for multiple duplication of model viz. Latex, soft vulcanising rubber and vinamould.

5.0 SUMMARY

This unit has taught us that duplication is the act of reproducing another model, accurately, from the original or master cast. It has also taught us

that duplication are made for various reasons ranging from: for processing of dental appliance in order to ensure that finished prosthesis maybe fitted on master cast during trimming and finishing process so as to save surgery time. It is also for metal works, in such situation, duplicates are made in refractory investment materials; for studies and as a reference material for orthodontic treatment and for dental boards. It has also taught us that any deviation or alteration during duplication renders the duplicate quite different from master cast or original model thereby making appliance constructed on such duplicate impossible to fit.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define duplication of model and justify the reasons behind it.
2. Identify materials for duplication of model and describe procedure using reversible hydrocolloid material.

7.0 REFERENCES/FURTHER READING

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MODULE 4 SPECIAL IMPRESSION TRAY AND BITE REGISTRATION BLOCK

UNIT 1 OVERVIEW OF SPECIAL IMPRESSION TRAY

CONTENTS

1.0 INTRODUCTION

Every mouth is unique and differs quite distinctly from another mouth. Impression is a detailed reproduction of the features and landmarks of the oral cavity in its negative form on which model material is poured to form the cast. Virtually all impressions do not get the accurate details due to the ill fitting nature of stock impression trays. They do not extend fully into the sulci and other intricate areas of the mouth. This reason makes it difficult for impressions obtained with stock impression trays to get every peripheral detail. These necessitate the use of impression tray that will obtain all necessary details, hence special impression trays.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the meaning of special impression trays
- discuss the reasons for producing special impression trays
- enumerate the ideal requirements expected of every special impression tray.

3.0 MAIN CONTENT

3.1 What is Special Impression Tray?

Special impression tray is a dental device designed and customised or tailor made to conform with the individual's jaw in order to obtain a closely fitting and accurate impression of such individual jaw from which appliances are made.

Because a more satisfactory and accurate impressions are obtained using special impression trays, it is imperative that preliminary models obtained by the use of stock impression trays serve in diagnosis and in the fabrication of special impression trays.

Special impression trays usually carry impression materials into every detail or part of the jaw without undue over extension of such impression which is common with stock trays. The use of special impression trays ensure the impression are confined to desired area.

3.2 Ideal Requirements of Special Impression Trays

Every special impression tray is expected to conform to certain basic requirements. These requirements are what enable the special impression trays to fulfill the required objectives for which they are made.

These requirements are:

i. Must not be too closely adapted to the cast. The aim of this is to have a space into which impression materials are loaded. This can be achieved using a spacer between the cast and tray material.
ii. Wings or flanges of tray must not be adapted into undercuts and must not impinge on attachments. This can be achieved by giving a 2mm relief to the sulci/attachments.
iii. The posterior borders of upper trays must extend to the junction of hard and soft palates; lowers must extend to cover the retromolar pads.
iv. Must be strong/thick enough to withstand applied pressure even in thin sections.
v. Handles must be fixed securely and of same material with tray except where contra-indicated such as non-brittle compound material (compo) and Shellac where wires are used.
vi. For edentulous trays, the handle must be higher than the tray with about 8-10mm. This can be obtained by the incorporation of a crank or upstand of the above stated measurement. The aim of the

crank/upstand is to prevent displacement or distortion of lips and sulcus tissue during impression taking.

vii. Must hold impression in correct position and cover the area required in the impression.

viii. Must be clean and smooth because sharp edges may injure oral tissues.

ix. For dentate trays, the handle must be at the same level with the highest point of the cast; parallel to the working bench.

x. Must be dimensionally stable on the cast and in the mouth.

xi. Must be compatible with all impression materials.

xii. For retention of impression materials, trays are either perforated or un-perforated in which case; adhesives are used during impression taking.

xiii. Must prevent distortion of impression during setting and removal from the mouth.

xiv. Must be easy to use or manipulate so as to enable manipulation to required shape.

xv. The tissue or inner surface should be free from voids or projections.

The above outlined requirements ensure that every special impression tray fulfils the objectives for which it is constructed.

4.0 CONCLUSION

In this unit, you learnt what special impression tray is. You also learnt why special impression trays are made. The unit has equally given us a detailed account of the ideal requirements of every special impression tray.

5.0 SUMMARY

In this unit, you learnt the meaning of special impression trays and the rationale for their construction. You have also learnt the properties of special impression trays which enable the trays to fulfill the objectives of their production.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define and state why special impression trays are made.
2. Mention five (5) ideal requirements of an average special impression tray.

7.0 REFERENCES/FURTHER READING

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UNIT 2 MATERIALS AND PROCEDURES FOR SPECIAL IMPRESSION TRAYS CONSTRUCTION

CONTENTS

1.0 INTRODUCTION

Like in every dental device design and construction, there are specific materials and procedures for the various devices. Special impression trays being one of the devices has its particular set of procedures for their construction. These procedures, if not followed, will produce an adverse effect which might lead to non achievement of desired result(s). Materials for construction of special impression trays have their own chemical compositions and these materials have their own handling techniques so as to achieve optimal results. It is therefore with the knowledge that handling of materials for the construction of special impression trays follows a particular and definite sequence; and therefore should be handled as such.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- name and identify the various materials for the design and construction of special impression trays
- discuss the various procedures for the design and construction of special impression trays based on the individual materials
- differentiate the special trays for edentulous and dentate oral cavity
- identify special impression trays that do not meet the basic requirements expected of such trays.

3.0 MAIN CONTENT

3.1 Materials for Construction of Special Impression Trays

Special impression trays are made from various materials depending on the desire of the practitioner and the impression technique being followed. Each has its merits which justify its use. Some of the commonly used materials are: Impression compound (non-brittle or type II) materials, shellac base plate, acrylic resin and metallic (alloys) materials.

The use of any of the tray materials and the construction method is dependent on the preference of the practitioner. Some practitioners prefer tray with a space for the impression material while some others prefer that the tray be closely adapted to the cast with no intervening space. If a space is to be provided it is created by adapting a spacer. It is also a practice to incorporate stops on the inner surface of the tray so as to provide definite seat in the mouth. This can be made by cutting small spots out of the spacer at certain points, about three (3), on the crest of the ridge before the application of the tray material.

Impression compound (type II)

This is the less brittle type of compound impression material. It is generally weak and possesses no flow property when compared with ordinary impression compound due to the presence of higher content of filler.

Shellac base plate

The shellac base plate used for special impression tray is generally thicker than the normal shellac base plate. This is to enable the

possession of enough strength to withstand applied pressure. Usually handle is made of different material and attached to the tray.

Acrylic resin

This material which is a product of polymerisation of the liquid and polymer of methyl methacrylate is the same as the denture base material. It can be either heat cured or auto polymerising and is widely used for special impression tray construction. Both tray and handle can be made together or separately depending on the size of investing flask

Metallic materials

This can be tin, lead or solder. The procedure involves the use of wax of form the pattern and investing same in plaster of Paris to form mould into which the metal (molten) is poured into. This is probably the strongest of all special impression trays, suitable for all impression materials.

3.2 General Procedure for Construction of Special Impression Trays

This is the general procedural outline which does not involve the intricate details associated with individual materials. This is meant to give a board overview of the procedures for special impression trays construction.

Steps:

1. Outline the periphery of tray on the model
2. Cover model with a spacer as appropriate and shape
3. Adapt the tray material and trim adequately
4. Attach the handle as required and smoothen
5. Perforate the tray if desired or roughen the fitting surface.

3.3 Procedures for Construction of Special Impression Trays using Individual or Different Materials

3.3.1 Construction of Special Impression Tray using Impression Compound (Compo) Materials

This is a less brittle and weaker type of compo. The procedure involves the following steps:

Tray construction:

i. Outline the periphery of tray on model
ii. Cover with thick damp canvas or dental napkins to serve as spacer and trim adequately
iii. Soften compound as usual using hot water at about $60^{o}C$ and flatten to about 2cm thickness using a smooth roller (rollette unit).
iv. Soften the material again and conform to the model carrying the spacer.
v. Trim the compo to size using scissors while still pliable
vi. Soften the material and conform again, and trim accurately.
vii. Chill the tray and file the edges properly and to requirements to fit the outlined periphery.
Handle construction and fitting:

- Shape from a suitable wire using pliers and adapt to model (bearing in mind the type of model).
- Replace tray on model with damp canvas or dental napkins between the tray and model.
- Warm the handle in a flame and press gently into tray ensuring that the handle is straight (parallel to working bench).
- Cover wire ends properly by pressing a softened impression compound (compo) over it using fingers.
- Smooth with file or any other hand instrument.

Upon successful attachment of handle to the tray:

a. Flame the tray carefully to shine
b. Provide retention for impression materials by roughening the inside of tray using hot wax knife. Alternatively, the tray can be perforated using a hot instrument or wire. Where perforation is done, the surface of the tray should be carefully smoothened with file to prevent rough surface.

Points to note:

i. Do not overheat the compo
ii. Do not under or over extend the tray
iii. Do not file across edges of tray to prevent flaking.

3.3.2 Construction of Special Impression Tray using Shellac Base Plate

The shellac base plate used in the construction of special impression tray is usually thick enough to withstand applied stress.

The procedure involves the following steps:

Tray:

i. Outline the periphery of tray on model
ii. Cover with thick damp canvas or dental napkins to server as spacer
iii. Soften Shellac base plate on flame and adapt to model to conform
iv. Trim roughly using scissors while the shellac is pliable or with fret saw when the shellac is cold.
v. Soften the edges of shellac and conform again
vi. File the Shellac to the outline made on model and smoothen edges ensuring that it's rounded.

Handle:

i. Shape from a suitable wire using pliers and adapt same to model.
ii. Replace tray on model with damp canvas or dental napkins between the tray and model
iii. Warm the handle in flame and press gently into tray ensuring that the handle is perpendicular to the tray.
iv. Cover wire ends using wax knife to press softened shellac over the tray.
v. Smoothen tray and handle using file; paying particular attention to the edges to ensure that they are rounded.

Upon successful completion of the above stated procedures, perforate the tray with hand instrument for retention of impression materials.

Point of note:

i. Do not overheat Shellac to prevent burning
ii. Do not over extend or under extend the tray
iii. Do not file tray across edges to prevent flaking.

3.3.3 Construction of Special Impression Tray using Acrylic Resin

This material is widely used for construction of special impression trays. They can be made in either heat cured or auto polymerising acrylic resin. Both tray and handle can be made together or separately depending on the size of investment flask

The procedures involve the following steps:

Tray:

i. Outline the periphery of tray on model
ii. Cover the model with one (1) or two (2) sheets of modeling wax. (The number of sheets of modeling wax is dependent on the type of impression materials to use and level of space to incorporate between the tray and the mucous membrane); adapt and trim to periphery; smoothen the wax properly.
iii. Dust the surface of wax with talc or French chalk to serve as separating medium
iv. Cover with and adapt one (1) or two (2) sheets of wax to form the tray, and trim properly
v. Prepare handle from one or two sheets of wax incorporating a crank or upstand if the model is edentulous but not if it is dentate, especially where there are standing anterior teeth.
vi. Attach the handle using hot wax knife ensuring firmness, if the flask available is big enough to contain the tray and handle in one piece, but where the flask cannot take both in one piece, they are invested separately and processed after which the handle is attached to the tray using self curing or auto polymerising acrylic resin.
vii. Withdraw the tray and handle, smoothen edges to ensure rounded periphery and flask in a plaster to the periphery to form the mould. Allow the plaster to set.
viii. Apply-separating medium, allow to dry and fill the other half of the flask with plasters (topping). Allow the plaster to set.
ix. Boil out in hot water and flush wax properly
x. Apply separating medium and allow to dry
xi. Mix the appropriate consistency of acrylic resin and pack into mould (at dough stage) ensuring proper closure of flask.
xii. Polymerise by heating in appropriate temperature if heat cured acrylic resin is used while if self cured or auto-polymerising resin is used, allow to cure itself.
xiii. Cool, if heat cured, deflask, trim properly and polish ensuring rounded edges.

The tray can either be perforated for retention of impression material or can be left unperforated in which case adhesive will be used for retention of impression material.

3.3.4 Construction of Special Impression Tray using Metallic Material (Alloy)

Metallic special impression trays are used with any impression material.

The procedures for this involve the following steps:

i. Outline the periphery of tray on model
ii. Wax up model using an appropriate wax to serve as spacers and French chalk adequately
iii. Adapt a sheet of wax to form tray and trim appropriately
iv. Form the handle from a sheet of wax and attach appropriately ensuring firmness.
v. Withdraw the tray pattern and invest in a plaster or 50/50 mixture of plaster and silica but before attempting this, ensure that the silica is of very fine particles and equal size. This is to ensure smooth surface. Allow to set completely.
vi. Apply separating medium allow to dry and fill the other half of the flask with investing material and allow to set completely.
vii. Upon setting, boil out the wax pattern to create a mould into which molten metal is poured into (casting). Allow to dry completely
viii. Create vent for escape of air
ix. Preheat the mould (to ensure that the temperature of the mould is not far lower than the molten metal and no moisture is in the mould)
x. Melt and pour the metal (alloy) through the handle and allow to solidify
xi. Chill and remove the tray from mould
xii. Trim the surfaces and edges, perforate the tray using bur mounted on hand piece for use with any type of impression material.

Note:

i. When pouring the molten metal, gently vibrate the mould to ensure or assist complete casting
ii. Do not pour molten metal into cold mould
iii. Metal used should have low melting range.
Differentiating between Edentulous and Dentate Special

Impression Trays

An edentulous jaw is that which has no standing tooth on it while dentate or dentulous jaw is that which has at least a standing tooth on it. Trays made for edentulous jaws have their handles attached on them with incorporation of a step, upstand or crank. This enables the tray to be used for impression without displacement of the lips. The cranks usually are made to be about half an inch and at right angle to the tray. This crank enables the tray to sit on the ridge and the handle comes up allowing the lips to remain undistorted or undisplaced during impression taking.

On the other hand, trays for dentate models have their handles attached just straight (parallel to the working bench) on the tray without an upstand, step or crank especially where there are standing anteriors. Where there is no standing tooth, the handle do not displace the lips.

4.0 CONCLUSION

You have learnt the various materials for the construction of special impression trays. These materials range from non-metallic to metallic. The construction of special impression trays requires procedures which are strictly followed in order to achieve the desired results.

You learnt the individual materials for the construction of special trays and also the intricate details of their handling which show that their differences in composition necessitate the different methods of handling so as to achieve optimal result.

5.0 SUMMARY

This unit has enabled the identification of the various materials for the design and construction of special impression trays. It has discussed the various procedures available to us for the construction of the special impression tray and has differentiated the trays for edentulous and dentate oral cavity. Deviation from normal standard procedures entails trays that do not meet with the basic requirements expected of them.

6.0 TUTOR-MARKED ASSIGNMENT

1. Special impression trays are made in different materials and this entails different procedures. Outline in details the procedures for the construction of special trays using impression compound.
2. What is the difference between an edentulous impression tray and a dentate tray; and explain the reasons for the difference.

3. Discuss the design and construction of special impression tray using auto polymerising acrylic resin.

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UNIT 3 BITE REGISTRATION BLOCK: OVERVIEW

CONTENTS

1.0 INTRODUCTION

Bite registration block, also referred to as occlusion registration block is an appliance designed and constructed for the purpose of recording the relationship between the maxillary and the mandibular jaws. The recording of this relationship is to ensure that functional dentures can be made successfully by allowing proper arrangement of teeth, proper occlusion, aesthetics, comfort and above all, preservation of oral tissues and structures. Bite registration block is required for every patient with insufficient standing natural teeth. These insufficient standing natural teeth make proper occlusion impossible. By means of occlusion registration block, the length and width of artificial teeth to be used in setting up are determined. The practitioner uses this appliance in determining the midline, canine positions or eminences and functional or rest bite. The use of bite registration block helps to give general aesthetic qualities to dentures as it becomes a “road map” or “blue print” by which the practitioner designs and constructs dentures.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the concept of bite registration block
- enumerate the reasons why bite registration block are needed by patients and practitioners
- identify bite registration block that meets or does not meet the ideal requirements expected of it.

3.0 MAIN CONTENT

3.1 What is Bite Registration Block?

Bite registration block which is also referred to in different other names such as “occlusion registration block”, “Occlusion rim”, “Occlusion record block” or “Jaw relationship record” is a dental appliance constructed for the purpose of recording or establishing the correct anatomical relationship between the maxillary and mandibular jaws.

Generally, bite registration block consists of two (2) types: 1) complete or full bite registration block and 2) partial bite registration block.

Complete or full bite registration block is that which is designed and constructed for edentulous case, while partial bite registration block is for dentate or partial case.

3.2 Purpose of Bite Registration Block

When a patient is edentulous, opposing teeth contact is not obtained when the mouth is closed. This is because the vertical stops (teeth) are absent. In such a situation, the patient can continue closing his or her mouth until the ridges of upper and lower jaws make contact, thereby loosing the vertical dimension. When such patients are at rest position, the lower jaw is suspended under the upper jaw. In both situations, closed and rest, the vertical dimension is not established and as such any appliance constructed and fitted on such patient will not be functional. In order to obtain an appliance that will be functional for such patient, bite registration block is required which attempts to record the jaw to harmonise these three dimensions-closed, rest and vertical, in centric relation.

Any attempt at constructing an appliance without harmonising the three (3) dimensions produces one that effects rapid resorption of residual ridges, temporo mandibular dysfunction, joint dysfunction or negative consequences to the supporting structures of the teeth.

Bite registration blocks are constructed in order to register the functional relationship between upper and lower jaws in centric occlusion. It enables the appliance so constructed to be aesthetically and functionally accepted. These are achieved through the registration of the midline of the mouth/face, canine eminences/positions, occlusal stop/plane position, upper and lower smile lines and ultimately determination of vertical dimension in centric occlusion.

3.3 Components of a Bite Registration Block

Every bite registration block consists of two basic components viz. the base and the rim.

3.3.1 The Base

The base is the replica of the base of denture that is used in recording the relationship between the maxilla and the mandible. It consists of a hard or rigid or strengthened materials in order to withstand pressure, prevent war page or distortion at mouth temperature. The base of a bite registration block usually carries the rims.

3.3.2 The Rim

The rim is the occluding surface of a bite registration block mounted on a base. It is usually soft and more workable for ease of manipulation and adjustment. It is on the rim that recordings are made and are transferred on the denture to obtain a functional appliance.

3.4 Ideal Requirements of a Bite Registration Block

For a bite block to be used on a patient, it is expected to fulfill certain ideal condition. This is because any material used in the mouth ought to be inert without producing any harmful or negative effect.

These ideal requirements can be classified into two (2) categories in accordance or in line with the components of bite registration block viz bases and rims.

Base plates requirements:

i. Ease of manipulation in order to ensure close fitting or adaption to the mucosa.
ii. Posses sufficient strength and rigidity even in thin section to withstand biting force during recording.
iii. Should retain its shape at mouth temperature (dimensionally stable at mouth temperature).
iv. The extent and shape of its border should resemble that of finished denture.
v. Non toxic, non irritant to the mouth tissues.
vi. Should permit its use as base for setting of teeth.
vii. Should be of desirable colour which contrasts with oral tissues.

Occlusal rims requirements:

i. Must be dimensionally stable at mouth temperature
ii. Must be non toxic, non irritant to the mouth tissues
iii. Should posses ease of manipulation
iv. Should conform to the overall curvature of the ridge
v. Should extend posteriorly to the point on the ridge where the ramus begins to ascend.

Consequent upon completion of the construction or assemblage of the component parts of a bite registration block, the overall appliance should have the following requirements or properties:

- Should be dimensionally stable in all parts
- Must be non toxic and non irritant to the mouth tissues
- The rim must be securely attached to the base
- The rim must be directly over the ridge
- All surfaces must be smooth with the occlusal surface flat
- The height of rims, anteriorly, must not exceed 22mm from the functional depth of the sulcus for maxilla and 18mm for mandible
- The width of rim should be 4-8mm anteriorly and 6-9mm posteriorly
- The height of rims, posteriorly, must not exceed the heel of retromolar pad for the mandible while the maxilla should slope slightly lower than the anterior height
- For partial cases, the height and width of rim should not exceed that of standing adjacent teeth
- The appliance must not touch the tongue, cheek, lips and muscles attachments.

Note:

Considering the various measurements stated above, many authorities have argued that they are based on the teeth not being worn. Considering that majority of patients who wear complete dentures are elderly and would have worn natural teeth, the measurements should be reduced.

Above assertion not being jettisoned, the measurements are retained bearing in mind that it is easier to remove rim materials during registration than to add.

4.0 CONCLUSION

The unit has looked at the meaning of bite registration block as well as the purposes of bite registration block construction. It has also looked at the various components viz. base and rim. The ideal requirements of the appliance have not been left out hence their detailed, separate requirements were enumerated.

5.0 SUMMARY

Having completed this unit, the basic concept of bite registration block has been explained. The reasons why a bite registration block is essential for the construction of dentures have also been explained. The ideal requirements or properties of a bite registration block and its components to ensure comprehensive knowledge have been taught also.

6.0 TUTOR-MARKED ASSIGNMENT

1. Bite registration block has been described in various ways. Concisely summarise the purposes of its construction.
2. Why is it essential to have the base of a bite registration block made of rigid material?
3. In partial bite block construction, what are the guiding principles?

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UNIT 4 MATERIALS AND METHODS OF CONSTRUCTING BITE REGISTRATION BLOCK

CONTENTS

1.0 INTRODUCTION

Every dental appliance has certain objectives to meet. To fulfill these objectives, such appliance is expected to posses certain characteristics. These characteristics are based on the composition of the materials and the method(s) of their manipulation to obtain the appliance. Bite registration block is therefore not an exception to these basic rules and fundamentals. There are certain materials that are used for construction of bite registration block and the achievement of the required result is based on the meticulous implementation of the recommended procedure.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- enumerate and identify the various materials available for the construction of bite registration block.
- discuss the various methods or techniques of construction of bite registration block based on individual materials.

3.0 MAIN CONTENT

3.1 Materials for Base Plates Construction

There are basic materials for construction of base plates and the choice of each is based on the reasons or purposes for which the bite registration block is required.

These materials are shellac base plates, modeling wax (base Plate wax), acrylic resin (auto polymerising and heat cure) and metals (Gold alloys and cobalt chromium alloys)

3.1.1 Shellac Base Plate

This material is made in different shapes for maxilla and mandibular jaws. This is a product of resinous exudates of a scale insect; it is combined with other materials such as talc which serve as filler to increase the strength of the materials. Shellac base plate is a thermoplastic material which softens when heated and hardens on cooling.

Base formation procedure:

i) Survey and block out all undercuts with plaster and pumice or wax.
ii) Outline the periphery of base plate with pencil and apply French chalk on the cast.
iii) Soften shellac sheet over a flame and adapt on the cast or place shellac sheet on the cast and flame with Bunsen burner and adapt. Allow to cool.
iv) Trim base plate until its edge is lingual to the crest of the ridge.
v) Extend the posterior border to the junction of hard and soft palates (if upper) and trim all edges.
vi) Re-soften the base plate and readapt on cast.
vii) Serrate or roughen the edges with hot wax knife to assist in retention of rim. The serration must not exceed 4mm from the crest of ridge.

Alternatively, wire retainers may be used in place of serration. To achieve this, the wire is shaped as desired using suitable pliers. Flame the wire and embed in the shellac lingual to the crest of the ridge.

3.1.2 Modeling Wax (Base Plate Wax)

This is an advantageous material in the construction of base plates for bite registration block. This is because it is easy to manipulate but the only disadvantage being its dimensional instability at mouth temperature. Although, experts have tried to overcome this with the use of wire strengthener but because of its thermoplastic nature, it is susceptible to war page on heating and cooling. Waxes are more suitable for the construction of rims and setting or positioning of teeth.

Base formation procedure:

i) Survey and block out all undercut areas using plaster – pumice.
ii) Outline the periphery of the base plate on cast with pencil and apply French chalk (separating medium).
iii) Lightly soften and adapt wax sheet and cut to shape.
iv) Bend and fit wire just below the crest of ridge, lingually, to strengthen the base plate and obviate dimensional instability in the mouth. For upper, the wire is adapted at the posterior border across the palate. Ensure that the position of wire will not interfere with teeth positioning during setting up. Smoothen the wire and wax surface.

3.1.3 Acrylic Resin (Auto Polymerising and Heat Cure)

This is a frequently used material for construction of bite registration base plate. It offers great stability at mouth temperature. It has the advantage of giving the exact position and stability of finished denture in the mouth.

The only disadvantage is the time and material consumption in duplication of the model. The essence of duplication being to ensure that if model is affected in the process of making the base plate, the master cast is there for the construction of denture/appliance.

Construction procedure:

i) Survey and observe areas requiring relief; block out all severe undercuts.
ii) Outline the periphery of tray on model.
iii) Apply French chalk or talc.
iv) Soften and adapt a sheet of base plate wax on the model and trim appropriately to the outline (about 2mm short of the outline).
v) Flask the pattern in a denture flask of appropriate size (flasking can be done with cast or pattern removed from cast and flasked) and allow to set.

vi) Apply separating medium, preferably, cold mold seal and allow to dry.
vii) Top the second half of the flask and allow to set.
viii) Boil out the wax and after cooling of the mould, apply separating medium on the surfaces of mould and allow to dry.
ix) Mix an appropriate consistency of acrylic resin (auto polymerising or heat cure) and pack into mould as usual.
x) Cure in appropriate curing cycle, if heat cure resin is used but if auto polymerising resin is used, allow to self cure.
xi) Bench cool, deflask and recover the base plate.
xii) Smooth the periphery and polish. Store in water until it's ready for use.

3.1.4 Metals (Gold Alloys, Cobalt Chromium Alloy)

Metals are used for the construction of bite registration base plates. They offer good stability at mouth temperature. Though, not so popular because of time and materials consumption as it requires duplication of cast in refractory material before the other procedure start

Procedure:

i. Survey and block out all undercuts. Outline the periphery and block out the relief chambers as designed (if these were not done before duplication).
ii. Spray the cast with model spray or dip in molten bees wax to protect the model from subsequent procedures and allow model to dry on a dry towel.
iii. Select a suitable thickness of pattern or casting wax and adapt to the cast starting from the center and then outwards to the periphery to prevent fold formation. Trim appropriately.
iv. Adapt another sheet of wax to form the transition between the metal and resin.
v. Apply retention beads or wax mesh on the crest area of the pattern.
vi. Sprue the base plate properly and dip into a debubbliser to reduce surface tension. Blow off excess surface tension reducing material.
vii. Prepare investment material using the manufacturer's recommended water-powder ratio to mix.
viii. Invest the pattern in a suitable investment ring and allow to set.
ix. Burnout the wax by placing the investment in a furnace. Burnout temperature and time vary with the refractory investment materials used and the type of alloy to be cast. Allow sufficient time for heat soaking.

x. Prepare the casting machine by wounding the arm as appropriate and lock. The metal to be cast is placed in the crucible for melting. Melting method used is dependent on the type of casting machine (whether induction casting or ordinary centrifugal).
xi. Upon reaching the casting temperature (molten state of the metal), allow for heat soaking of the metal. Remove the casting ring from furnace and place on the cradle of the casting machine.
xii. Release the locked arm of the casting machine and the casting completed.
xiii. Remove the casting ring from the cradle and allow to bench cool.
xiv. De-invest the cast and sand blast to remove particles of investment material. Cut off sprue and finish the cast properly to ensure fit on the master cast without rocking.
xv. Smooth and blunt the edges and periphery of the cast appropriately and polish in a suitable polishing material

A finished metallic base can be used as the denture base material also.

3.2 Materials for Rim and Construction

There are certain materials used for the construction of occlusal rims. They are generally softer and wore workable than the base materials. These materials are – modeling wax, bees wax/ paraffin wax, compound and plaster-pumice.

The essence of the occlusal rims is to record or transmit important information obtained during recording of the jaw relationship.

3.2.1 Modeling Wax Occlusion Rim

Modeling wax is usually supplied in flat sheets of different dimensions. Their use as occlusal rim follows their rolling into a pencil shape.

Procedure:

i. Soften the modeling wax on a flame and roll into pencil shape ensuring that no air is trapped
ii. Position the softened roll directly over the ridge on the base plate and compress to appropriate height. Mold excess material downwards to obviate waxing up
iii. Smoothen sides with hot wax knife, adding wax where necessary ensuring that the width and height of rim are in line with requirements
iv. Smoothen finally using Bunsen flame or air syringe and polish wax in cold water using cotton wool.

3.2.2 Bees Wax/Paraffin Wax Rim

When these materials are in sheet form, they are handled just like the modeling wax. Alternatively, they are melted and poured into a preformed shape. This performed shaped wax is softened to a temperature that will allow for adaptation to the base plate and further treated like the modeling wax.

3.2.3 Compound (Compo) Rim (Wax-Wafer Recording)

Bite registration block with composition rim is used for a wax-wafer recording. In wax-wafer recording, the occlusal rim is constructed to about 1mm shorter than normal height in order to accommodate the wax wafer between the rims.

Procedure:

i. Adapt the base plate on the cast, usually a strong base plate such as acrylic resin or metal
ii. Incorporate retention devices for the rim
iii. Soften composition, form into rolls and adapt on the ridge
iv. Smoothen all sides while ensuring that the rim is firmly secured to the base
v. Reduce the rim when hard using sand paper. Alternatively, soften the rim using a pointed flame and compress on a wet glass slab or porcelain slab; cut away excess materials before it hardens
vi. Incorporate 'V' shaped groves on the occlusal surface of rims for retention of wax-wafer.

The rim is constructed shorter than normal with about 1mm to accommodate the wax-wafer. Therefore, for an edentulous jaw, there will be space of 2mm for wax- wafer.

3.2.4 Plaster – Pumice Rim (Grinding – in Procedure)

Plaster–pumice rims are used for functional techniques in which the mandibular movements are used as an articulator to "grind – in" the occlusal surfaces of the rim until even gliding contact is produced.

The rim is obtained by a mixture of plaster and pumice at equal parts by volume with an appropriate quantity of water to form a paste with sufficient consistency strength to be able to stand molding into shape without collapsing.

A strong base plate such as acrylic resin is used in order to ensure firmness and comfort required during "grinding-in".

Procedure:

i) Replace base plate on the cast (model)
ii) Apply plaster-pumice paste on the ridge and smoothen sides while ensuring that the height of rim is about 1.5mm higher than normal to give room for "grinding-in".

4.0 CONCLUSION

In this unit, you learnt the various materials and procedures for construction of bite registration block. The unit has identified the various materials for base plates and that of rims. These materials range from shellac base plate, modeling wax, acrylic resin (both auto polymering and heat cure) and metallic materials (gold alloys and cobalt chromium). The rim materials ranges from modeling wax, bees wax/paraffin wax, compound and plaster – pumice.

The use of each of these materials depends on the type of bite registration required and the level of firmness expected of the base plate to possess.

5.0 SUMMARY

This unit has taught the various materials available for the construction of bite registration block and the various methods or techniques of construction of bite registration blocks based on the various materials.

6.0 TUTOR-MARKED ASSIGNMENT

1. List the three materials each available for the construction of occlusal rims and base plates.
2. Outline the procedure for construction of bite registration block using heat cure acrylic resin base and modeling wax rim.
3. When do you use plaster pumice as a rim material.
4. What differentiates plaster-pumice bite block rim from composition rim.

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UNIT 5 MAXILLOMANDIBULAR RELATIONSHIP RECORDING AND MARKS

CONTENTS

1.0 INTRODUCTION

Usually when the lower jaw is at rest position, it assumes a position which gives a distance quite different from that when the opposing teeth are in contact. This relationship which the lower jaw bears to the upper jaw is in accordance to individual's anatomy and physiology. Individuals with natural standing teeth normally have these teeth contacting each other in opposing direction when the mouth is in normal occlusion. This contact determines the distance between the functional depth of the upper jaw and that of the lower jaw. When the teeth are absent, no contact is made and therefore this distance becomes difficult to determine. In order to estimate and determine this distance, the need for establishment of the relationship between the upper and lower jaws becomes imperative.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- measure and establish the relationship between upper and lower jaws of edentulous patients
- determine the vertical distance between jaws at different positions
- identify various marks on registered bite block and discuss their importance.

3.0 MAIN CONTENT

3.1 Jaws Relationship Recording

This is the establishment of relationship between upper and lower jaws. Temporomandibular Joint (TMJ) is that which controls the movement of the lower jaw. It is capable of producing complex movements and the various movements vary from each other. The TMJ is a bilateral hinge joint which must work together to produce various movements.
In establishing the relationship between the jaws in an edentulous patient, a lot of factors are put into consideration. This is to ensure symmetry of the face; good appearance; phonetic; ability to chew; and unstressfulness of the TMJ. Jaws relationships are recorded in two different positions viz. rest position of the lower jaw and occlusal position.

Rest position

When the mouth is in normal rest position, the opposing teeth do not meet as there is a space or gap between the upper and lower teeth. This gap or space known as free way space or inter occlusal clearance/distance is approximately 2-4mm.

Occlusal position

When the mouth is closed, the condyles return to their position in the glenoid fossa and the lower jaw moves upwards till the teeth meet in opposing direction within their normal intercuspidated position. At this position, the free way space is eliminated.

In edentulous case, there are no natural teeth; determination of the vertical distance between upper and lower jaws in occlusal position becomes difficult. In order to establish the distance, an estimate of 2–4mm is subtracted from the distance determined at the rest position.

Establishment/Recording of the Jaws relationship are done by:

i) Insert the upper bite registration block, as produced, into the patient's mouth
ii) Soften the rim of lower bite registration block in water bath or over a flame and insert into the patient's mouth too.
iii) Gently guide the patient to close his/her mouth in unstrained position till it gets to already determined vertical distance

3.2 Marks found on Registered Block and their Importance

3.2.1 Vertical Dimension (VD)

This is the space in which the denture is to occupy. It is obtained in various ways depending on the experience of the practitioner.
VD is either postural (rest) or occlusal.

Postural/Rest VD

This is the vertical distance between the upper jaw and lower jaw when the mouth is in normal rest position. At this state, the facial muscles are relaxed and the condyles are in the most unstrained position. This VD includes a space of about 2-4mm known as free way space or inter-occlusal clearance/distance. This VD is also known as relaxed VD.

Occlusal VD

This is the vertical distance between the upper and lower jaws when the mouth is closed. At this point, the condyles return to their position in the glenoid fossa and the lower jaw moves upwards till the opposing teeth meet each other. This distance has no free way space. Also known as "Retruded VD".

Vertical dimension indicates the space to be occupied by an appliance. It must neither be increased nor decreased unduly during the construction of appliance otherwise the patient will experience difficulty in speaking, masticating and poor appearance, as well as pains and TMJ dysfunction; soreness on the corners of the mouth (oral cheilitis); cheek biting and clicking teeth.

3.2.2 Occlusal Plane (OP)

This is an arbitrary clinical registration mark on bite registration block to enable the teeth to be set up to a given plane. This plane marks the position or line of the incisal edges and cuspal points by which set teeth relate to each other. OP helps in determining the extent of the incisal or cutting edge of upper central incisors. The upper central incisors must extend beyond the OP during setting up. Setting up without reference to OP gives a poor aesthetics and the possibility of the appliance not sitting properly and dropping off position is very high due to lips pressure effect.

3.2.3 Midline (ML)

This is the imaginary vertical line which bisects the face. In normal natural dentition, the upper central incisors have their mesial surface in contact with this line except where diastema exists. For aesthetic and functional reasons, the artificial substitutes should be in the same position as the natural teeth. This line is supposed to be marked on the Labial surface of the bite registration block but in its absence on the block, the position of the incisive papillae or labial frenum is used as a reference by the Dental Technologist during setting up.

Though there is no hard or fast rule to its determination, setting up without reference to the midline gives a poor appearance thereby negating on the cardinal principles of appliance construction. Midline is also called centre of the face or centre line.

3.2.4 Canine Lines (CL)

The canine lines mark the corners of the mouth when the lips are relaxed. The lines suppose to coincide with the tips of upper canines. The lines indicate the sizes (width) of anterior teeth to be used during setting up of complete denture appliance. The distance from canine line to canine line contains the six (6) upper anteriors. Setting up without reference to it means that the transition between the anterior teeth and posterior teeth will give aesthetic eyesore, poor fit of appliance and inefficiency in mastication.

3.2.5 Upper and Lower Smile Lines

These lines also referred to as high lip line and low lip line respectively. These lines are marked on the upper bite registration block and lower bite registration block. They are the lines in contact with the lower border and upper border of the upper and lower lips respectively when they are moved up as high as possible and as low as possible unaided or in smiling or laughing. They indicate the amount of the denture appliance to be seen under normal conditions. They help in determining the length of upper and lower teeth needed in the construction of prosthodontic appliances. Upper central incisors should be about 2mm longer than the distance between occlusal plane and upper high smile lines; so also the lower central incisors. They help ensure aesthetics and functionality of appliance.

4.0 CONCLUSION

In this unit, you learnt the recording of jaw relationship in relaxed position, when the head of the condyles are in their most unstrained position as well as in occlusal position, when the opposing teeth are in contact. In the former position, there exists a space of about 2 – 4mm between the upper and lower teeth. This space is known as free way space or inter-occlusal clearance/distance. The later contains no free way space.

You have also looked at the various marks found on a registered bite block viz.:

- **Vertical Dimension** which indicates the distance between the functional depth of upper and lower sulci. This distance is occupied by prosthodontic appliance.
- The **Occlusal Plane** which is an arbitrary registration on the bite block which enables teeth to be set to a given plane. It indicates the position of the incisal edge of upper central incisors and cuspal points.
- The **midline** which bisects the face into two. It indicates the position of the mesial aspect of upper central incisors.
- **Canine lines** mark the corners of the mouth when the lips are relaxed. They indicate the size of anterior teeth to be used during setting up of complete denture.
- **Upper and lower smile lines** indicate the length of teeth to be used during setting-up as the central incisors ought to be about 2mm longer than the distance between the occlusal plane and smile lines.

5.0 SUMMARY

This unit has taught us the establishment of relationship between upper and low jaws of edentulous patients; the determination of the vertical distance between the jaws at rest and occlusal positions. It has also taught us the various marks seen on registered bite block and their significance and importance in setting up prosthodontics appliance as well as the negative consequences of their negation during setting-up.

6.0 TUTOR-MARKED ASSIGNMENT

1. Differentiate between Postural/Rest Vertical Dimension and Occlusal Vertical Dimension.
2. What is Midline and how does it affect the appearance of appliances?
3. Smile lines are important in setting up Prosthodontic appliances. Discuss?

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UNIT 6 MOUNTING OF REGISTERED BITE BLOCKS ON ARTICULATOR

CONTENTS

1.0 INTRODUCTION

The procedures involved in the construction of prosthodontic appliances especially completes denture involve intricate details which require the replication of movements of the mandibular jaw. In order to achieve this, since these procedures are not carried out in the oral cavity, the need to employ an apparatus which will carry out duties of the jaws arise.

A response to the need for that apparatus therefore gives rise to the articulator. An articulator therefore performs the various movements of the mandible as well as the fixed or stationary position of the maxilla.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define articulator and articulation
- identify the various types of articulator and the procedures for mounting models on them
- enumerate the various ways by which marks on registered bite block are transferred on to mounting plaster.

3.0 MAIN CONTENT

3.1 What is an Articulator?

An articulator is a mechanical device which represents the temporomandibular Joint (TMJ) by its hinge and both jaws by its arms upon which models are mounted or attached for the purpose of setting up to reproduce the various excursions or movements of the jaw. These movements are basically three (3) viz: (i) simple opening or downward movement of the mouth (ii) forward and backward movement of the mouth and (iii) lateral or sideways movement.

These movements hardly take place individually or separately rather a complex movement of the jaw is undertaken during function or sleep. These movements can be reproduced by certain articulators once they are recorded and transferred to such articulators. When recording of jaws relationship has been completed, the bite registration blocks are transferred to the articulator which performs the duties of the jaws and the Tempora mandibular Joint. This process of transferring and attaching of registered bite block is termed mounting or articulation. The process of attaching the bite block on an articulator is aided by the use of gypsum product, any other material or devices to enable setting up of teeth to a given plane.

3.2 Purposes of Articulator

The purpose of articulator and mounting of models on them are to:

- facilitate the functions of the jaws in undertaking the various movements
- enable the models to be held in a determined fixed relationship
- hold the models to the articulator so that setting up maybe accomplished.
- enable the recording of registration marks on mounting plaster for reference purposes.

3.3 Classification of Articulators

Articulators have been classified variously in different ways based on the inclination of their inventors or classifier. For the purpose of this study the classification based on adjustability of the articulator will be adopted hence the most popular in recent history.

Articulators classification based on adjustability are:

- Simple hinge or plane line articulators
- Free plane or average movement or semi adjustable articulators
- Fully adjustable articulators (anatomical).

Simple hinge plane line articulator

This is one that incorporates and reproduces only the vertical opening movement of the mandible by the lower arm of the articulator. It is a hinged device for the vertical occluding of the models after mounting.
The features of simple hinge articulator include their non-adjustability. Teeth set up using simple hinge do not offer balanced articulation as their contact is in constant position in which the models were related or registered.

Free plane/average movement/semi adjustable articulator

This type of articulator incorporates and reproduces vertical opening, protrusive and lateral movements representing the functional excursions of the mandible. This type of articulator incorporates a fixed but sloping incisal table which minimises incisal or cuspal locks. This slope is an average of many natural condylar slopes. The reason behind the use of this fixed condylar path is to enable the positioning of teeth during setting up so as to eliminate cuspal lock during function and subsequent dislodgement of the appliance. The effect of this being multi point contact relationship of teeth during mandibular movement.

Fully adjustable or anatomical articulator

This type of articulator stimulates the various and individualistic movements of the jaw. It incorporates a circular adjustable discs, one on each side, which enable specific condylar angles to be set on the articulator. This type of articulator enables teeth to be set to ensure balanced occlusion and articulation.

Balanced occlusion and articulation enable the teeth to maintain even sliding contact relationship between opposing teeth during mandibular movement from one occlusion to the other without causing cuspal interference or dislodgement of the denture.

3.4 Mounting of Models

This is the procedure or act of attaching the maxillary and mandibular models to the arms of the articulator. This process follows the completion of registration or recording of jaw relationship.

It is aided by the use of gypsum product or any other material or device to enable setting up of teeth to a given plane as recorded or registered.
Before attempting mounting procedure with any articulator, it should be properly examined to ensure that it's conditions are optimal. It therefore follows that there are certain requirements expected of any good articulator to posses. These requirements are:

- It should be capable of holding the models in correct vertical and horizontal relationships as registered.
- The moving parts should be free from any obstruction especially the hinge.
- The models should be easily attached and removed without difficulty.
- The articulator should be easily adjustable in order to maintain contact of the models as registered and should have sufficient space to enable such adjustment.

3.4.1 Mounting of Models on Simple Hinge

As stated above, simple hinge articulator offers only a vertical or one line opening and closing of the arms. Because the upper and lower models represent both jaws respectively, they are mounted on the separate arms of the articulator which has been seen to be in good order without any defect especially at the hinge section.

Mounting the lower model

1. Roughen or serrate the base of the models (upper and lower) so as to ensure and improve union between the models and mounting plaster.
2. Assemble the bite registration blocks on models (as registered) and secure both models together using pieces of wire or match stick and sticky wax.
3. Soak models in cold water for few minutes to ensure saturation of both models surfaces to enable good union with mounting plaster.
4. Grease or oil the arms of the articulator slightly.
5. Make an appropriate consistency mix of plaster and place same on the work bench (plaster room) or glass slab.
6. Place lower arm of articulator in the plaster and add more plaster to cover the arm of articulator.
7. Raise the upper arm of articulator and position the model on the plaster (lower arm)
8. Smooth or shape the plaster surface with the model and allow to set.

Note:

i. Check articulator hinge properly to ensure that it is in good order and oil arms of articulator adequately.
ii. Ensure that the occlusal plane as registered on the bite registration block is horizontal (parallel) and midway with the articulator arm and or work bench and that the midline or centerline is straight and at right angle to the articulator arm or work bench.
iii. Ensure that mounting plaster adjoins the shoulders of articulator arm.
iv. Ensure that the mounting plaster is vertical on the sides.
v. Ensure that the models do not move during mounting procedure.

Mounting the upper model

1. Soak or wet the upper model again and raise the upper arm of articulator.
2. Place a little amount of plaster on the model and lower the arm.
3. Cover the arm with more plaster and shape appropriately.
4. Allow to set and trim adequately using model trimming machine.

Shortcomings of simple hinge or plane line articulator

As indicated, plane line articulator undertakes only vertical movement and as such denture constructed on it will occlude only in retruded contact position but its articulation is very often unsatisfactory. This unsatisfactory articulation results in the following:

Tilting of the denture

Because registration obtained and transferred on plane line or simple hinge articulator is in centric occlusion, any attempt to apply pressure on one or two teeth in eccentric occlusion causes tilting of the denture.

Cuspal interference

Because dentures constructed using simple hinge or plane line articulator do not posses balanced articulation, any attempt to effect lateral, protrusive or any movement aside vertical when the teeth are in occlusion will result in the cusps locking or interfering with opposing ones and dragging bodily in the direction of the movement thereby causing dislodgement of the denture and consequent damage of underlying tissues.

Pain

As a result of the damage to underlying tissues, Pain follows. Any movement other than vertical effects contact of few teeth as against the entire teeth, these few teeth take all pressure applied thereby causing pain to the patient.

Reduced efficiency

As a result of the three (3) above problems, patient wearing appliance constructed on plane line or simple hinge articulator try to avoid certain movements, lateral and protrusive, and undertake only a vertical movement to ensure maximum contact of cusps. This vertical movement ensures only a crushing movement because grinding of food requires lateral and protrusive movements.

From the foregoing, it is seen that efficiency is impaired and relatively poor.

3.4.2 Average Movement or Semi Adjustable Articulator

Average movement/semi adjustable or free plane articulator unlike the simple hinge reproduces vertical opening, protrusive and lateral movements representing the functional excursions of the mandible. This possesses features which enable minimisation of incisal lock during mastication. The incisal guidance is fixed at 10^{o} while the condylar guide is fixed at 30^{o} which is seen as average of many natural condylar slopes. This type of articulator enables angulation of teeth during setting up so that cuspal locks during mastication and subsequent denture dislodgement maybe avoided. This effect results in multipoint contact of teeth during occluding mandibular movement.

Mounting procedure:

i. Examine the articulator to ensure that the accessories/assemblages are in good order. Oil the arms of the articulator, the model securing wires and model locks adequately.
ii. Roughen the base of models; assemble the registration blocks on the models and secure firmly using pieces of wire or match stick and sticky wax; and soak models in water.
iii. Assemble the accessories or assemblages of the articulator in their proper order or position. Such accessories are occlusal plane indicator, incisal guidance pin.

a. Ensure that the occlusal plane indicator tallies with the occlusal plane.
b. The indicator hole encircles the interjection of the midline and occlusal plane.

iv. Insert the incisal guidance pin in the vertical setting rod using it to hold the occlusal plane indicator in place. This ensures that the occlusal plane and midlines tally with the set articulator after mounting procedure is carried out.
v. Position the lower model on the pieces of plasticine placed on the lower articulator and adjust the assemblage on the plasticine until the incisal guidance pin tallies with the interjection of the occlusal plane and midline.
vi. Withdraw the pin and lift the upper arm of the articulator.
vii. Wet the base of the upper model; build up sufficient mixed plaster of paris on the base of model and lower the articulator arm.
vii. Remove excess plaster and trim to shape using plaster knife.
viii. Allow the plaster to set.
ix. Invert the assemblage, remove the plasticine and wet the base of lower model.
x. Heap an appreciable quantity of mixed plaster of Paris on the base of model (lower) and press the lower arm of articulator until the front setting rod makes contact with the incisal table.
xi. Remove excess plaster and trim to shape using plaster knife. Allow to set.

3.4.3 Fully Adjustable or Anatomical Articulator

This type of articulator is one which can be made to stimulate all forms of mandibular movements.

The procedure requires the use of compound as rim material in order to have a wax water recording as it requires more than one occlusal registration.

Prior to mounting of models, certain relevant data are required. These data are:

- Face bow record
- Centric occlusion or rest position record
- Record of protrusive, lateral (left and right) occlusions from which condyle paths angles can be recorded.

The process of collection of the above data is more of clinical issues and as such can be dealt with in subsequent/ more advanced texts.

3.4.4 Transfer of Registration Marks

This is the measurement and transfer of the marks seen on the registered bite block to the mounting plaster for reference purpose.

These marks are transferred by taking a reference point on the model and with the spring divider, measure the various marks and transfer.

Procedure:

1. Take a reference point on the model (upper or lower) preferable in line with the center or midline; parallel to the occlusal plane.
2. Using spring divider, measure the distance of the various marks and mark same on the side of the mounting plaster.

Identify each mark with a clear symbol or alphabet.
The marks are lower smile line; occlusal plane; upper or high smile line; canine lines and vertical dimension.

The essence of these marks is for check after the setting up to ensure that the teeth have been placed correctly based on the registration obtained.

4.0 CONCLUSION

In this unit, you have learnt about articulators and their purposes. You have also learnt about the classification of articulator viz. simple hinge articulator, average movement and fully adjustable articulator. You also learnt about transfer of registration marks, the process and reasons for the transfer of these marks.

5.0 SUMMARY

This unit has taught us the meaning of articulator and articulation. It has also taught us the various types of articulator and the ways by which the models are mounted on them.

The unit also taught us how to transfer the marks seen on a registered bite block and the reasons for such transfer.

6.0 TUTOR-MARKED ASSIGNMENT

1. Describe the mounting of models using semi adjustable articulator.
2. Enumerate three ideal requirements of a good articulator.
3. Briefly discuss two short comings of simple hinge articulator.

7.0 REFERENCES/FURTHER READING

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