

*Vocational Higher Secondary  
Education (VHSE)  
Second Year*

**DENTAL TECHNOLOGY**  
*Reference Book*



Government of Kerala  
Department of Education

State Council of Educational Research and Training (SCERT),  
KERALA  
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## Foreword

Dear Learners,

This book is intended to serve as a ready reference for learners of vocational higher secondary schools. It offers suggested guidelines for the transaction of the concepts highlighted in the course content. It is expected that the learners achieve significant learning outcomes at the end of the course as envisaged in the curriculum if it is followed properly.

In the context of the Right- based approach, quality education has to be ensured for all learners. The learner community of Vocational Higher Secondary Education in Kerala should be empowered by providing them with the best education that strengthens their competences to become innovative entrepreneurs who contribute to the knowledge society. The change of course names, modular approach adopted for the organisation of course content, work-based pedagogy and the outcome focused assessment approach paved the way for achieving the vision of Vocational Higher Secondary Education in Kerala. The revised curriculum helps to equip the learners with multiple skills matching technological advancements and to produce skilled workforce for meeting the demands of the emerging industries and service sectors with national and global orientation. The revised curriculum attempts to enhance knowledge, skills and attitudes by giving higher priority and space for the learners to make discussions in small groups, and activities requiring hands-on experience.

The SCERT appreciates the hard work and sincere co-operation of the contributors of this book that includes subject experts, industrialists and the teachers of Vocational Higher Secondary Schools. The development of this reference book has been a joint venture of the State Council of Educational Research and Training (SCERT) and the Directorate of Vocational Higher Secondary Education.

The SCERT welcomes constructive criticism and creative suggestions for the improvement of the book.

With regards,

**Dr. P. A. Fathima**  
**Director**  
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## ABOUT THE COURSE

Dental Technology is a course which equips the Learner to be

- (i) A well trained, knowledgeable Dental Assistant in Dental Clinics and all hospitals.
- (ii) A Dental Lab Technician, a Denturist who fabricates and repairs Dental appliances

A dental assistant is a person who assists the Dental Surgeon in clinical procedures, does sterilization procedures and operates dental X-rays. A thorough knowledge of anatomy and sterilization procedure is necessary for successful execution of his/ her role.

A dental technician is also a person who acts as a bridge between the dentist and patient. He/she converts the expectations of the patient and the specifications of the dentist to reality. A thorough knowledge of the theory and the practical procedures is essential for the fulfilling the role of dental technician successfully

For the realization of these objectives, the Dental Technology course in Vocational Higher Secondary Education is spanned over a period of 2 years. The course is well planned and gives ample time and opportunity for the learner to develop the required skill to fulfill their respective jobs.

Dental assistant is a person not being a dentist or Medical practitioner, who assists the Dental Surgeon, in sterilizing and handling of instruments and various dental materials and medicines as required by the dental surgeon. Dental technicians also called Dental Lab Technicians; work in Laboratories fabricating dental prosthetics such as dentures bridges and crowns.

This two year course of study leads to the qualifications of VHSE trade Certificate in 'Dental Technology' awarded by the department of VHSE, Govt. of Kerala. The course of study consists of all essential elements required in a Dental Laboratory. Special emphasis is given to dental anatomy and morphology. The makeup of the human mouth and the development and placement of teeth, Dental Prosthetics - using of metallic and non-metallic materials, Dental ceramics, Orthodontics etc., including all the elements required for a good dental practicing technician.

The course is designed so that the learner:

- Receives the knowledge and expertise needed for being successful in his/her role
- Is familiar with the latest development in his or her field

Employment potential:

At the end of the course along with 1st year apprenticeship learner will be able to

- Assist dental surgeon in dental clinics and hospitals
- Work in dental laboratories
- Set up a lab of his own
- Works as health educator in companies
- Works in dental equipment manufacturing unit etc.

### **Major skills (sub skills)**

After the completion of module 3 the learner will be able to

## **MODULE 3-Fabrication Of Fixed Partial Dentures**

### **Major skills**

Ability to fabricate fixed partial dentures

### **Subskills**

Identify the different prosthetics

Design the denture with proper design

Assist in preparing anterior tooth for crown

Assist in preparing posterior tooth for crown

Distinguish between different gingival finish lines

Ability to duplicate cast using alginate

Ability to duplicate the cast with reversible hydrocolloid

Ability to assist in preparing an individual die

Ability to choose the ideal die system

Assist to fabricate the die

Fabricate wax pattern on anterior teeth

Fabricate wax pattern on posterior teeth

Fabricate the proper occlusal anatomy of posteriors

Ability to finish margins according to its anatomy

Differentiate different types of pontic

Choose the ideal pontic for a case

- Assist in spruing according to principles in single casting
- Assist in spruing according the principles in multiple casting
- Assist in performing investing procedure according to its principles
- Assist in performing burn out procedure
- Handle different types of casting machines
- Assist in removing the casting without damage to it
- Assist in performing the pickling procedure accurately
- Assist trimming and finishing the casting approximately
- Identify the causes of casting defects and ways to prevent them
- Manipulations of ceramic materials assist in the fabrication of ceramic crown
- Manipulation of investment materials
- Choose ideal alloy for casting
- Select materials for cast and die materials
- Identify the occurrence of corrosion and ways to prevent them

#### **MODULE 4 Fabrication of orthodontic appliances**

##### **Major skill**

Ability to fabricate removable Orthodontic Appliances

##### **Sub skills**

- Distinguish between normal and malocclusion
- Identify the consequence of giving uncontrolled orthodontic treatment
- Assist in the fabrication of devices like head gear
- Identify and categorise the different types of orthodontic appliances.
- Identify and choose armamentarium and materials used in wire bending
- Fabricate circle, square with different gauges of wire.
- Identify the different components of fixed orthodontic appliances
- Suggest the ideal components for the fabrication of removable orthodontic appliances
- Fabrication of different types of clasps
- Fabricate different types of bows
- Fabricate different types of springs

Fabricate coffin spring  
Fabricate removable orthodontic appliances  
Identify different myofunctional appliances  
Fabrication of oral screen  
Identify different space maintainers  
Fabricate different fixed space maintainers  
Fabricate removable space maintainers  
Fabricate different space maintainers  
Identify habit breaking appliances  
Fabricate different habit breaking appliances  
Identify the different typed of retainers  
Assist in dental lab in fabrication of different removable retainers  
Identify different types of fixed retainers  
Assist a dental surgeon in taking dental x rays  
Manage front office of dental clinic  
Assist dental surgeon during chair side treatment procedure  
Differentiate between soldering, welding and brazing  
Identify the role of flux and anti-flux  
Assist in freehand and investment soldering  
Assist in fabrication of molar bands for patient case

## SYLLABUS

### MODULE 3 : Fabrication Of Fixed Partial Dentures

<b>UNIT 3.1 Steps in casting</b>	(5 periods)
3.1.1 Introduction to prosthodontics	
3.1.2 Steps in casting	
<b>UNIT 3.2 Tooth preparations</b>	(10 periods)
3.2.1. Principles of tooth preparation	
3.2.2 Tooth preparation in anterior	
3.2.3 Tooth preparation in posteriors	
3.2.4 Gingival finish lines	
<b>UNIT 3.3 Cast duplication</b>	(15 periods)
3.3.1 Objectives of cast duplication	
3.3.2 Cast duplication with alginate	
3.3.3 Cast duplication with reversible hydrocolloid	
3.3.4 Electroforming of die	
<b>UNIT 3.4 Die preparation</b>	(20 periods)
3.4.1 Solid cast with individual system	
3.4.2 Pindex system	
3.4.3 di-lok and DVA system	
<b>UNIT 3.5 Wax pattern fabrication</b>	(90 periods)
3.5.1 Wax pattern fabrication on anterior teeth	
3.5.2 Wax pattern fabrication on posterior teeth	
3.5.3 Waxing up of occlusal aspect	
3.5.4 Finishing of margins	
<b>UNIT 3.6 Pontic</b>	( 1 0
periods)	
3.6.1 Classification of pontic	
3.6.2 Pontic design	

3.6.3 Types of pontic

**UNIT 3.7 Investing** (20 periods)

3.7.1 Sprue

3.7.2 Spruing procedure for single casting

3.7.3 Spruing procedure for multiple casting

3.7.4 Casting ring and liner

3.7.5 Investing

**UNIT 3.8 Burn out** (10 periods)

3.8.1 Alloy solidification shrinkage

3.8.2 Burn out procedure

**UNIT 3.9 Casting** (30 periods)

3.9.1 Casting machines

3.9.2 Melting of alloy

3.9.3 Casting of metal

**UNIT 3.10 Divesting and finishing** (20 periods)

3.10.1 Divesting

3.10.2 Pickling

3.10.3 Finishing and polishing

**UNIT 3.11 Casting defects** (20 periods)

3.11.1 Consequence of casting defect

3.11.2 Distortion of casting

3.11.3 Surface roughness and irregularities

3.11.4 Porosity

3.11.5 Incomplete casting with missing details

**UNIT 3.12 Fabrication of ceramic crowns** (10 periods)

3.12.1 Dental ceramic

3.12.2 Classification of dental ceramic

3.12.3 Steps in fabrication of ceramic crown and bridge

**UNIT 3.13 Materials used in casting** ( 6 0  
periods)

3.13.1 Investment material

3.13.2 Alloys used in casting procedures

3.13.3 Model cast and die materials

3.13.4 Finishing and polishing materials in casting

**UNIT 3.14 Tarnish and corrosion** ( 2 0  
periods)

3.14.1 Tarnish and corrosion

3.14.2 Types of corrosion

## **Module 4 : Orthodontics**

**UNIT 4.1 Introduction to orthodontics** ( 1 5  
periods)

4.1.1 Basics of orthodontics

4.1.2 Tooth movements in orthodontics

4.1.3 Anchorage

4.1.4 Orthodontic appliances

4.1.5 Instruments used for wire bending

4.1.6 Principles of wire bending

**UNIT 4.2 Fixed orthodontic appliances** (20 periods)

4.2.1 Components of fixed orthodontic appliances

**UNIT 4.3 Removable orthodontic appliances** (130 periods)

4.3.1 Components of removable orthodontic appliances

4.3.2 Clasps

4.3.3 Bows

4.3.4 Springs

4.3.5 Expansion components

4.3.6 Fabrication of appliance

- UNIT 4.4. Myofunctional appliances** ( 2 0  
periods)  
4.4.1 Introduction to myofunctional appliances  
4.4.2 Myofunctional appliances
- UNIT 4.5 Space maintainers** (10 periods)  
4.5.1 Introduction to space maintainers  
4.5.2 Fixed space maintainers  
4.5.3 Removable space maintainers
- UNIT 4.6 Habit breaking appliances** ( 2 5  
periods)  
4.6.1 Introduction to habit breaking appliances  
4.6.2 Habit breaking appliances
- UNIT 4.7 Retainers** ( 2 0  
periods)  
4.7.1 Retention  
4.7.2 Removable retainers  
4.7.3 Fixed retainers
- UNIT 4.8 Dental assistance part 2** (50 periods)  
4.8.1 Dental x rays, Front office management

Chair side management

### **UNIT 4.9 Soldering and Welding**

(50 periods)

- 4.9.1 Introduction to soldering and welding
- 4.9.2 Flux, antflux
- 4.9.3 Procedure for soldering

## **PART- B**

### **MODULE 3**

#### **Overview**

Module 3-dental mechanics 2 takes the learners through the procedures of crowns as well as fixed partial denture fabrication. It educates the learners on the casting defects that can occur in the dental lab during the process of fabrication which will compromise the quality of the denture and also the methods of prevention of these defects. The learner will also get knowledge about the materials and equipment used in casting. The learner will get an idea about the importance of tarnish and corrosion in dentistry.

**At the end of the module the learner will be able to**

- assist in the dental lab during casting procedures
- recognise the various casting defects.
- will be able to prevent the occurrence of casting defects.
- will be able to fabricate wax pattern on required tooth.
- will be able to identify the instruments and materials used in casting
- will be able to recognise tarnish and take steps to prevent corrosion
- will be able to select biocompatible metal or metal alloys that can resist tarnish and corrosion

### **UNIT 3.1**

#### **Steps In Casting.**

#### **Overview**

In this unit we review the terms used in prosthodontics .We also take the learners through the basic steps of casting giving an idea of the procedures involved in casting.

Basically, casting procedures involve the creation of a mould in the shape of the object to be fabricated and then filling the mould with metal.

**Learning outcomes** - the learners

- identifies different prosthetics
- enumerates the steps in casting.
- understands the importance of each step in casting procedures

## Unit in detail

### 3.1.1 Introduction to prosthodontics

Prosthodontics is the branch of dentistry that deals with the replacement of missing tooth. The prosthesis given can be fixed or removable. This unit deals with

- Types of prosthesis.
- Types of extra coronal restorations-crowns, laminates, veneers
- Types of intra coronal restorations inlay, onlay, pinledge
- Parts of fixed partial dentures

3.1.2- Steps in casting - various steps of casting steps are introduced. The steps that are dealt with in this unit are

**Patient valuation**

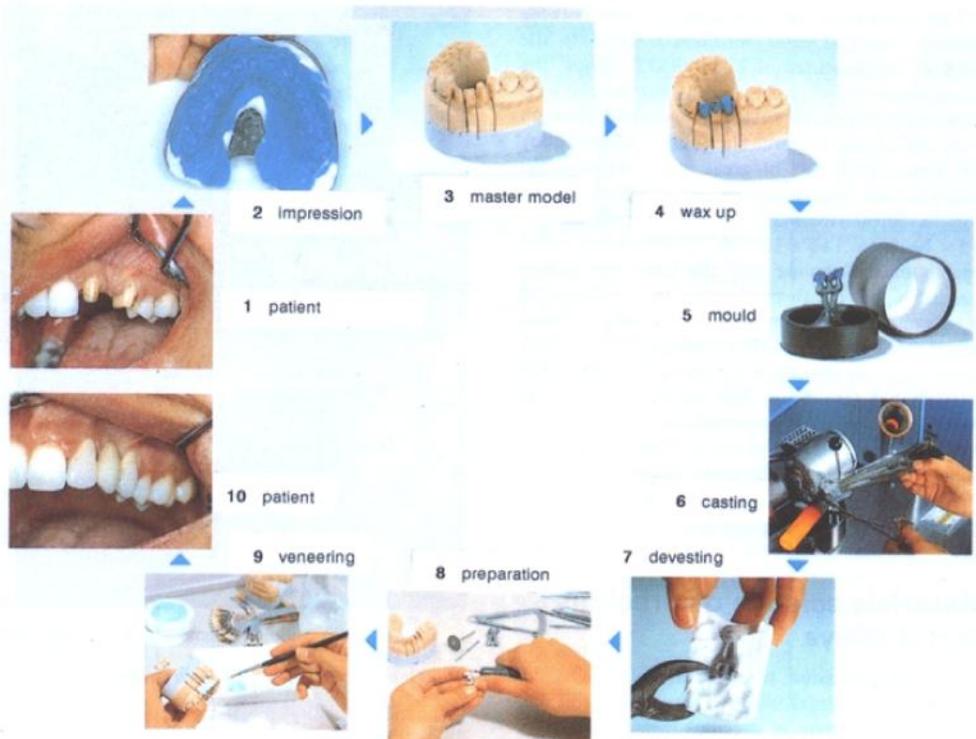
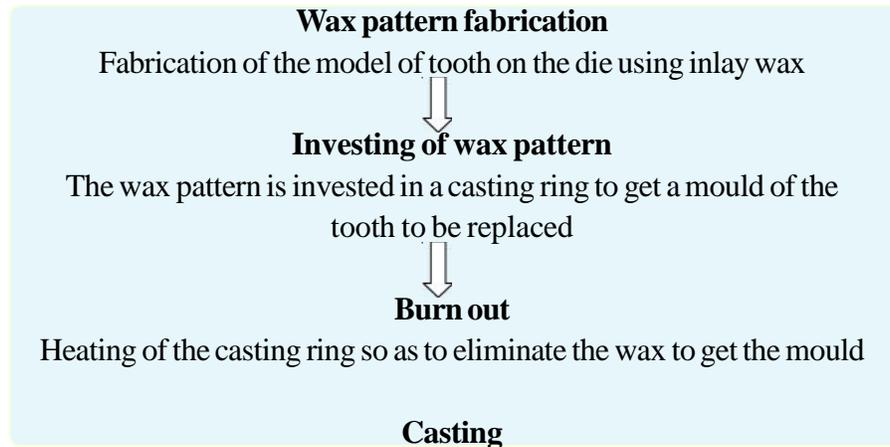
**Evaluation and designing of fixed denture**

**Tooth preparation and impression making**

Preparation of tooth to receive the crown, taking of impression using all inate

**Die preparation and cast duplication**

Preparation of die. Die is the positive replica of a single tooth. Cast duplication is also done during this stage. cast duplication is the fabrication of a second pair of cast in order to have a duplicate in case of damage to the master cast



*Casting Procedures*

Injecting the mould with molten metal to get a casting. Casting defect is also dealt with in the chapter

### **Divesting and finishing**

Removal of the casting from the casting ring, finishing and polishing of the casting

**Assessment activities:** Notes evaluation

Quiz-the learners are asked to identify the parts of denture from pictures and models

Chart preparation-the learners are asked to prepare album/chart depicting parts and different types of dentures.

Chart evaluation-chart depicting steps in casting.

Quiz/questionnaire based on steps of casting

Detailing of practical activities

- designing of fixed partial dentures. Suggest the number of units, abutment etc.
- Identification of various components of fixed partial dentures.

### **Sample Questions**

1. You are given a wax pattern of Mx right central incisor. Identify the steps you have to undergo to fabricate a metal crown for the above tooth (Hint: start the procedure with investing)
2. The part of the FPD that replaces the missing tooth is-----
3. Identify the part of FPD that connects pontic with retainer.
4. While on OJT you witnessed the casting of a metal bridge being done in the laboratory. Enumerate the steps of casting you saw in the proper order

## **UNIT 3.2**

### **Tooth Preparation**

This unit deals with the procedure of preparing the tooth to receive a crown or fixed partial denture. The accurate preparation of tooth and its impression is important for

the success of a crown or fixed denture. The learner will be able to identify the different gingival finish lines.

**Learning outcomes:** The learner

- design the denture with proper retention, and while preserving the tooth structure.
- assist in preparation of anterior and posterior tooth.
- recognise the gingival finish lines most suitable for each type of crown.

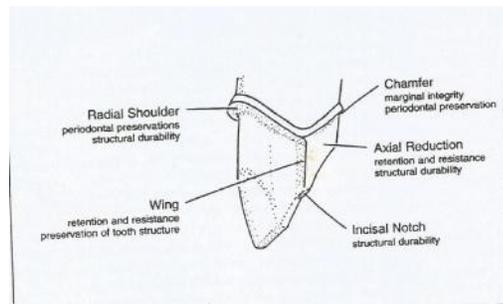
### Unit in detail

#### 3.2.1. Principles of tooth preparation:

Tooth preparation is defined as the mechanical treatment of dental disease or injury to hard tissues that restores a tooth to original form.

The principles of tooth preparation for receiving restorations are:

1. Healthy tooth structure should be preserved
2. The preparation should have acceptable finish lines for healthy periodontal relation as well as marginal integrity
3. Tooth reduction should be uniform to provide retention and resistance to the artificial crown..
4. The prepared tooth should show parallelism to resist displacement.
5. Structural durability should be assured.



*Prepared Anterior Tooth*

The preparation of tooth crown is different for different restorations.

#### 3.2.2. Tooth preparation in anterior:

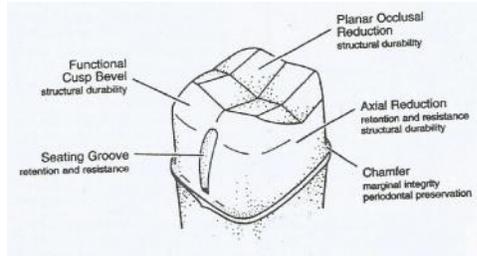
The steps for anterior tooth reduction for full metal crown are as follows:

- i) Depth orientation grooves are placed on the labial and incisal surface. This is for judging the tooth material to be removed.
- ii) The labial and incisal surface is reduced uniformly to the required depth.
- iii) The lingual surface is reduced to obtain a minimum clearance of 0.7mm

from the opposing tooth.

### Prepared anterior tooth

- iv) The axial surface is reduced adequately
- v) The gingival finish lines are accurately done
- vi) Finishing of the surfaces are done which also involves smoothening of the margins



*Prepared posterior tooth*

### 3.2.3 Tooth preparation in posteriors:

- i) The preparation is begun with occlusal reduction, creating about 1.5 mm clearance on the functional cusp. This is done by placing depth orientation grooves on the surface and then reducing uniformly to the required depth as indicated by the depth orientation grooves
- ii) The reduction of buccal and lingual surfaces is done. The chamfer finish line is formed during reduction
- iii) Proximal reduction is done taking care not to damage the adjacent teeth.
- iv) Finishing of surfaces and the gingival finish line done.



### 3.2.4 Gingival finish lines:

The tooth preparation terminates in a finish line -the gingival finish line. A proper finish line is necessary for the success of the restoration-aesthetically and functionally

Gingival finish lines can be

**Supra gingival**- the finish line is above the gingival crest. It is preferred in posteriors as it helps in maintaining of hygiene of restoration. Not preferred in anterior as it compromises aesthetics.

**Sub gingival** - the finish line is below the gingival crest. It is not preferred in posteriors

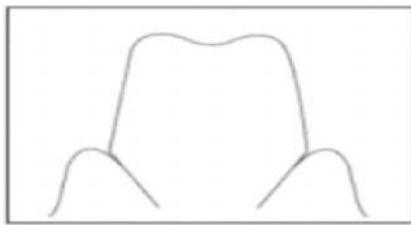


Figure 3a: Knife or feather edge

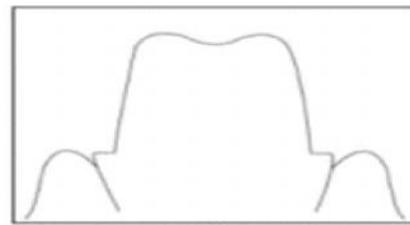


Figure 3b: Shoulder

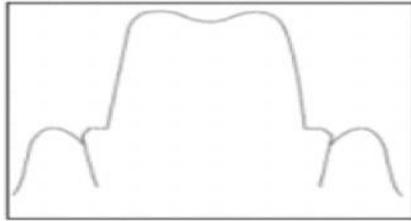


Figure 3c: Beveled shoulder

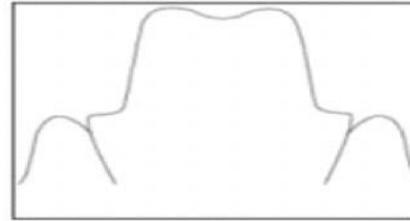


Figure 3d: Chamfer

*gingival finish lines*

but is the line of choice in anterior

Four types of finish lines are

- Shoulder-used in cases of complete ceramic crowns
- Bevelled shoulder-porcelain fused to metal crowns
- Chamfer-Indicated in cases of facial margins of metal ceramic crowns
- Knife edge-indicated in cases of metal crowns and sometimes for tilted teeth

**Assessment activities:** preparation of gingival finish lines on cast

- Demonstration of different types of gingival finish lines.
- Chart preparation of gingival finish lines
- Detailing of practical
- Identification of different gingival finish lines in the cast
- Notes preparation

preparation of posterior teeth in cast.

- video presentation on tooth preparation of posterior teeth

- Visit to dental clinic for demo of tooth preparation
- General discussion on identification of role of tooth preparation in obtaining retention
- preparation of anterior teeth in cast.
- video presentation of tooth preparation.
- visit to dental clinic for demo of tooth preparation

### Sample questions

1. List the different gingival finish lines.
2. Identify the gingival finish lines ideal for
  - a. Metal crowns
  - b. Ceramic crowns
3. You are asked to assist a dental surgeon while he is preparing maxillary central incisor for porcelain jacket crown. Enumerate the steps you witnessed during the procedure.
4. List the objectives of tooth preparation.
5. Identify the different finish lines
6. Importance of gingival finish lines.
7. Identify the different finish lines indicated in
  - a. Porcelain crown
  - b. Metal crown
8. List any three important points to be remember in tooth preparation that can enhances success of a crown.
9. List the Principles of tooth preparation
10. What is sub gingival finish lines.

## UNIT NO: 3.3

### Cast Duplication

Cast duplication is the method of fabricating an extra pair of casts in the laboratory.

This unit explains the need for cast duplication and the different methods by which it is done. The unit also deals with the electroforming of dies-the objective and method of electroforming of dies.

**Learning outcomes:** The learner will be able to- identifies the need for cast duplication

- assists in duplicating casts using alginate and elastomers
- assists in duplicating casts using reversible hydrocolloid
- identifies the need for electroforming of dies.

### Unit in detail

#### 3.3.1. objectives of cast duplication

Cast duplication is done in cases where an extra pair of casts is to be made or when the casts need to be in a different type of material like a refractory material.

An extra pair of casts is needed if the master cast is damaged.

Cast duplication is also done when a pair of refractory casts is needed.

#### 3.3.2. Cast duplication with alginate and elastomers

This is the most popular method because it is simple and economical.

The materials needed-

Impression tray, alginate, rubber bowl, spatula.

The impression tray should be a size bigger than the cast

The procedure of duplication is followed accurately

#### Procedure:

- The cast is examined properly .Any nodules are cleaned with a sharp knife. Voids are blocked with wax.
- The cast is soaked under water for almost 5 mts.This allows the air in the cast to escape. It also makes the surface of cast moist. If it is not moist it will absorb moisture from alginate and will interfere with the setting reaction
- An oversized perforated stainless steel impression tray is selected
- Alginate is mixed. Some of the mix is brushed on the cast so that all the details on the cast is duplicated.
- Cast is placed on a smooth, hard surface

- Mix is loaded on the impression tray and inverted on the cast. Some extra mix is placed around the sides of the cast.
- After the impression is set the cast is separated.
- A duplicate cast is poured in this impression with stone or refractory material.

The learners divided into groups and a discussion is initiated on the procedure witnessed. A report on the same is presented.

A questionnaire is prepared and the learners are quizzed on the topic.

### 3.3.3. Cast duplication with reversible hydrocolloid (Agar agar)

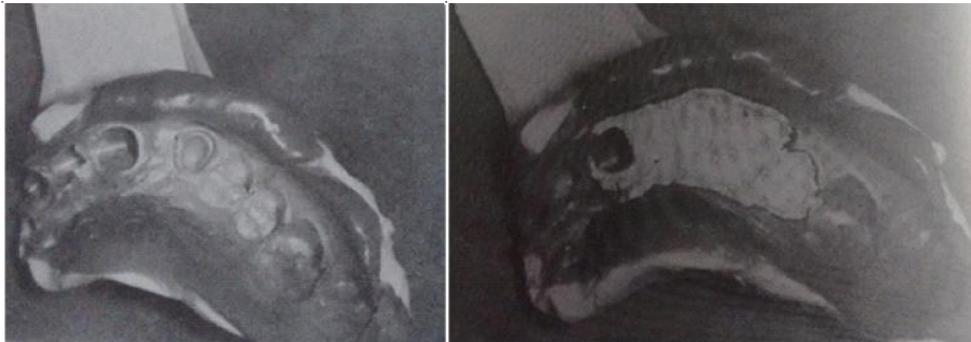
This method is very accurate and is widely followed in dental laboratories.

The material needed-dental flask, reversible hydrocolloid (agar agar).

The procedure of duplication is followed accurately.

#### Procedure:

- The cast is properly examined and cleaned.
- It is then soaked in warm water
- A duplicating flask is used for duplicating casts with agar agar
- Cast is placed on the bottom part of the flask..
- The flask along with the cast is placed in a pan
- The upper part is placed on the bottom part to close the flask
- Agar agar is heated. It is cooled until it can be held without discomfort
- It is poured into the flask through one of the openings



*Metallized impression*

*Electroplated impression*

- Ice cubes are filled in the pan
- After the flask is chilled the bottom layer is removed and the cast is separated.

The cast is poured in the impression with the required material.

### 3.3.4 Electro forming of die:

This method is generally not done in labs now a days .The main objective of the procedure is to make the die scratch resistant. The method involves depositing a layer of metal on the impression so that the die surface will be metallized .The objective and procedure is discussed.

**Assessment activities :** Video presentation of the procedure

Demo of procedure in practical lab or in dental lab during OJT/field visit

Detailing of practicals: Identification of the materials used in the cast duplication process

Spotters

### Sample questions:

1. Cast duplication is an important step in casting procedure
  - a) Write the importance of cast duplication.
  - b) Choose two materials ideal for cast duplication
  - c) Write the process of cast duplication with any one of the two materials chosen.
2. Identify the materials used for the following processes
  - a) Cast duplication with alginate
  - b) Cast duplication with reversible hydrocolloid material.
  - c) Electroforming of dies
3. We do not invest an ordinary gypsum cast but a refractory cast. Justify.
4. The positive replica of a single tooth is called "A"

- a) Identify A
  - b) Explain electroformed dies in detail.
5. Identify the purpose of cast duplication.
  6. Define cast duplication.
  7. Identify the different ways of cast duplication
  8. Differentiate an ordinary gypsum cast with a refractory cast
  9. Why a refractory cast is invested, not an ordinary gypsum cast.
  10. why the cast is soaked in water before cast duplication.

## UNIT NO: 3.4

### Die Preparations

An accurate die is mandatory for a successful prosthesis .A die should reproduce all the fine details of both prepared and unprepared surfaces of tooth exactly. This unit exposes the learner to different types of die systems. The learner will be able to choose the ideal system for the case. The procedure of die preparation is dealt with in detail.

#### **Learning outcomes:**

The learner chooses the ideal die system.

- assists in preparation of an individual die
- assists in preparation of die for casting procedures
- assists in die preparation

#### **Unit In Detail:**

##### **3.4.1 Solid cast with individual die system.**

Introduction to die systems, use /role of die systems, advantage and disadvantage of the die systems.

Solid cast with individual die system is a dual pour technique of die fabrication .The first pour is done for the prepared tooth and associated structures alone .This cast is removed and then a second pour of the whole impression is done .The 1st pour serves in the fabrication of wax pattern.



### 3.4.2 Pindex system:

This is amongst the more accurate of die systems. Here the die itself is removable. So, wax pattern need not be removed frequently from the die to check the proximal sides. This minimises distortion of wax pattern. The procedure of the fabrication of die is dealt with in detail.

### 3.4.3 Di-Lok and DVA system:

DVA system produces poured and pinned die system in just one pour. This die system is incredibly fast and easy to use.

Di-Lok system uses a special tray to fabricate the die. The tray has special grooves and can be dismantled and assembled. The grooves are used to do die sectioning.

Detailing of practical: spotters

**Assessment activities:** Questionnaire based on demo and video presentation

Notes evaluation

Scribbling pad evaluation

#### Sample questions:

1. You are given a patient impression for fabrication of die.
  - a) Enumerate the different die systems that you know of.
  - b) Explain the procedure of fabrication of die in any one system.
  - c) Which according to you is the most acceptable one? Justify
4. Pick the odd one out:
  - a) Pindex system
  - b) Di-Lok system
  - c) DVA model system
  - d) Direct sprue
5. Differentiate the items model, cast, dies.
6. Identify two die materials.
7. Define dies.
8. Explain electroformed dies.
9. Advantages of die preparation.

10. Classify die materials.

## UNIT 3.5

### Wax Pattern Fabrication

Wax pattern fabrication is done on the die of the tooth to be replicated. Following the steps for preparation of wax pattern is necessary for achieving the accurate anatomy of tooth as well as minimising casting defects. A finished wax pattern resembles the shape of a final restoration and contributes to the aesthetics and proper functioning of tooth.

This unit deals with the steps of wax pattern fabrication on the die. Proper adherence to the steps is necessary to fabricate an ideal wax pattern.

#### Learning outcomes:

The learner

- Fabricates wax pattern on anterior teeth
- Fabricates a wax pattern with proper occlusal anatomy
- Fabricates wax pattern on posterior teeth
- Finish margins according to anatomy

#### Unit in detail

##### 3.5.1 Wax pattern fabrication on anterior teeth:

Fabrication of an accurate wax pattern matching the natural morphology is important for enhancing the aesthetics as well as the functional efficiency of a denture/crown.

General steps to be followed before starting the fabrication

- The die and master casts are mounted on an articulator
- The die surface is checked for undercuts and other surface irregularities. And they are corrected.
- Finish lines are pronounced by marking a line with sharp wax colour pencil.
- 20-40mm thick die spacer is painted on the die surface. This is to provide cement space. This is a space provided between the internal surface of the crown and the tooth surface for the luting cement.

#### Procedure:

The basic procedure is the same for anterior and posterior teeth

- a) Waxing up or coping: wax is added on the surface by two methods.
- a large waxing instrument is heated and immediately touched to the inlay wax. Wax melts and flows. The entire surface is covered with wax.
  - dip the die in molten wax till sufficient thickness is reached.

The 1st layer should be done with the wax fully molten.

Additional layers are added to make the coping sufficiently thick.

Proximal (M&D) sides are made slightly bulky to help grip the coping while removing the die.

- b) Wax cones are positioned at the incisal angles and melted
- c) The tooth is carved according to anatomy
- d) While carving labial surface aesthetics is given priority.
- e) The contact areas on the proximal surfaces are maintained
- f) Margin is trimmed and evaluated.
- g) The pattern is removed and carefully replaced .This is to check the adaptability to the die surface.
- h) The wax pattern is cleaned and polished. This removes any extra dirt on the wax surface before investing. Finishing also increase the aesthetics of the restoration.

### 3.5.2 Wax pattern fabrication on posterior teeth:

The procedure of wax adaptation remains the same as on anterior teeth. The wax is melted and the die is covered with wax layer of sufficient thickness.

Waxing up of proximal surfaces- proximal contact area is placed on the occlusal third of the crown. The surface is built flat or slightly concave occluso gingivally till the contact area.

Waxing up of axial surfaces-The buccal/lingual are waxed so that it should look like the surface of the natural teeth. The contour of the teeth is important. The wax pattern should follow the anatomy of tooth, size, shape and bulkiness.

### 3.5.3 Waxing up of occlusal aspect:

The occlusal aspect of posterior teeth has many anatomical landmarks. The reproduction of these landmarks is essential for the proper functioning of the restoration.

The main objective is to- shape the surface to resemble that of natural teeth.

- the masticatory forces should be directed along the long axis of the tooth.

**General principles:**

1. Occlusal schemes-this refers to the position of the cusps. The contact relation of the opposing teeth depends on the opposing cusps.

There are two schemes:

- a) Cusp marginal ridge scheme-Here the buccal cusps of lower premolars and the MB cusp of lower 1<sup>st</sup> molar occludes with the embrasure between the upper teeth
  - b) Cusp fossa scheme: here the buccal cusps of lower premolars and MB cusp of lower 1<sup>st</sup> molar occlude with the mesial fossa of corresponding upper teeth.
2. Cusp height and position: The right height and position of cusp is needed to provide stability and resistance to wear .The position of the functional cusps should be such that it occludes with the buccolingual centre of the opposing tooth.
  3. Curve of spee is incorporated
  4. Curve of Wilson is incorporated

**Procedure:**

- Wax cones are placed on occlusal surface in the original position of cusps.
- Functional cusps are built
- Non-functional cusps are built
- After cusps are formed it is checked for interference.
- Wax is added on the cusps and carved to make cusp ridges. Triangular ridges, fossae, sulcus, marginal ridges are carved

Wax is added on the rest of the occlusal surfaces and other morphological features are carved. The articulator is closed and occlusion is checked

**3.5.4 Finishing up of margins:**

Immediately before investing the margins are finished. The wax near the margins are melted and finished again.

This is to

- provide perfect adaptation of restoration
- to provide plaque control
- to prevent /minimise dissolution of luting cement.

The wax pattern is washed, placed on the die and checked for any extra particles. They are completely removed. Final corrections are made and the wax pattern is ready for investment

**Assessment activity:** The finishing done on the wax pattern in lab is assessed.

Discussion on the video presentation

Detailing of practicals: waxpattern fabrication on incisors, canines, 1st molar

### Sample questions:

- 1) You are given a patient cast for fabrication of wax pattern on maxillary right central incisor. Write the steps you will undergo for fabricating the wax pattern.
- 2) You are given the die of maxillary molar for preparation of wax pattern for crown. What are the guidelines you will follow for the preparation for the same?
- 3) Identify the materials and instruments used in the preparation of a wax pattern.
- 4) The steps followed in the wax pattern fabrication of upper central incisor.
- 5) Identify die relief or die spacer
- 6) Purpose of cement space
- 7) Identify the reasons behind the finishing the margins before investing.
- 8) What are the reasons for using the wax for pattern making.

## UNIT 3.6

### Pontics

Pontic are artificial replacement of missing tooth. It is the suspended member of the fixed partial denture. This unit deals with classification and types of pontic. The learner will be able to choose the pontic design according to the position of missing tooth.

Learning outcomes: The learner

- Differentiates between types of pontic



- Chooses ideal pontic
- Designs a pontic with regard to the position of missing tooth
- Understands the principles involved in designing a pontic

### **Unit in detail**

#### **3.6.1 Classification of pontic**

Definition: Pontic is defined as an artificial tooth on a fixed partial denture that replaces missing natural tooth

Classification of pontic

1. Depending on mucosal contact
  - a. mucosal contact
    - Ridge lap pontic
    - Modified ridge lap
    - Ovate
    - Conical
  - b. non mucosal contact
    - Sanitary pontic
    - Modified sanitary
2. Depending on material used
  - Metallic pontic
    - Gold alloys
    - Nickel chromium alloys
  - Non-metallic pontic
    - Acrylic
    - Porcelain
  - Combination pontic
    - Metal fused to ceramic pontic
    - Alloy with acrylic facing

3. Prefabricated/fabricated
4. Depending on position of pontic  
Anterior/posterior.

### 3.6.2 Pontic design

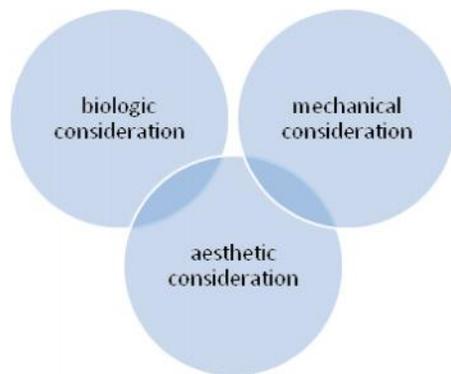
The dental technician should be able to choose the ideal pontic design for a patient case. In order to do that he should be familiar with the ideal requirements of pontic as well as the factors that has to be considered while selecting a pontic.

The ideal requirements of pontic are:

- Should restore function of the missing tooth
- Should restore aesthetics
- Should permit proper oral hygiene
- Should preserve the underlying mucosa

Should be non-toxic and should be biocompatible with the oral tissues.

The factors to be considered while selecting a design are



#### 1. Biologic consideration

The effects of the design on oral hygiene, the integrity of mucosa, transmit a force to mucosa etc. has to be considered.

The design should be such that it is easy to maintain oral hygiene. There should be enough space between the oral mucosa and pontic so that the area is self-cleansable.

The pontic should only have a passive contact with the underlying mucosa. It should not impinge on or injure the mucosa.

The occlusal forces should be directed to the abutment teeth alone and not the mucosa.

## 2. Aesthetic considerations

The pontic design should be such that it should resemble the missing tooth in size shape, function and appearance. The pontic should be polished and finished so that there is no accumulation of food debris which can lead to plaque and calculus formation. All surfaces of the pontic should be smooth.

## 3. Mechanical consideration

The pontic design should be such that it can withstand occlusal forces.

### 3.6.3 Types of pontic

The different types of pontic are

- Sanitary pontic
- Ridge lap pontic
- Modified ridge lap pontic
- Conical pontic
- Ovate pontic

**Sanitary pontic** (hygienic pontic): The tissue side of pontic does not contact the ridge at all. The gap allows cleaning. These are mainly used in case of mandibular molars.

**Ridge lap pontic** (saddle pontic): The tissue surface is concave and covers a ridge. Not easily cleansable. It promotes plaque accumulation. It is aesthetically pleasing.

**Modified ridge lap pontic:** A mixture of sanitary and ridge lap pontic. Only facial surface contacts the ridge. On lingual side the pontic does not touch the ridge. So it minimises plaque accumulation. Easy cleaning possible. It is used in upper and lower anteriors, premolars and upper molars.

**Conical pontic:** It is used where aesthetics is not important. It is suitable when its ridge is knife edged. It has minimum tissue contact. Easy maintenance of oral hygiene.

**Ovate pontic:** It is aesthetically pleasing. The tissue surface is completely convex and makes minimum contact with ridge. It has a very natural look

**Assessment activities:** seminar, chart preparation on types of pontic-the pictures

of different types of pontic are given

**Sample questions:**

1. Identify the type of pontic given in the figures, (figures to be given)
2. You are asked to design a pontic in the anterior region. Explain the factors to be considered while designing a pontic?
3. Identify the ideal pontic in the situations given below
  - a. position of mandibular molars
  - b. region of upper anteriors
  - c. region of upper premolars
- 4) Classify pontic
- 5) Requirements of ideal pontic
- 6) Factors to be considered during designing of pontic
- 7) Give the diagrammatic representation of atleast three types of pontic

## UNIT 3.7

### Investing

Investing is the procedure of creating a mould in the shape of the object to be casted. Proper adherence to the investing procedure is important to get a defect free casting. The chapter deals with the procedure of casting of dental crowns and partial dentures. The 1st step in investing is sprue attachment. The wax pattern with sprue is then invested in the casting ring.

**Learning outcomes:**

The learner

- understands the role of sprue
- assists in spruing on single casting`
- assists in spruing on multiple casting
- understands the role of casting ring and liner in investing

- assists in investing the wax pattern accurately

## Unit in detail

### 3.7.1 Sprue

A sprue is a wax pin used to provide a channel through which the molten alloy reaches the mould after wax elimination. Attachment of the sprue is the 1st step in investing. Proper selection of size and configuration of the sprue former is critical to the production of a dense, complete and accurate casting.

Ideal requirements of sprue

1. The sprue should allow the passage of wax pattern on heating.
2. The sprue should provide a channel for passage of metal into the mould.
3. The sprue should have a reservoir so that the molten alloy remains molten in the sprue a little longer than in the mould

#### Principles of spruing:

1. The sprue should be short and thick and not long and thin. Ideally the sprue length should be such that the wax pattern is close to the centre of the casting ring.
2. Sprue attachment. Sprue is attached to the bulkiest portion of the wax pattern. The connection of the sprue to the wax pattern is flared.
3. Sprue position. It can be attached to occlusal surface or the proximal surface.
4. The sprue should be directed away from the thin section. The molten alloy should not flow to a bulky section through a thin section.
5. The sprue should not be attached at right angles to a broad surface.



#### Types of sprue:

1. Direct sprue-this kind of sprue does not have a reservoir. It provides a direct connection between wax pattern and sprue base
2. Indirect sprue-this kind of sprue has a reservoir which is positioned between the pattern and the base

### 3.7.2 Spruing procedure for single casting

- procedure for spruing for single casting

### 3.7.3 Spruing procedure for multiple casting

- pro metal when solidifies shrinks-this will cause defective casting

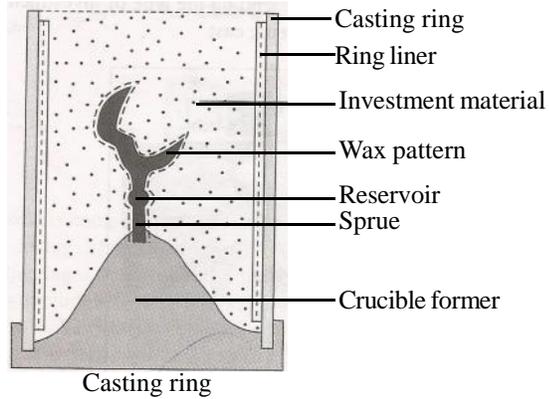
3.7.4

Casting ring is a metal ring that holds the investment material during setting. Crucible former to compensate for this, the mould is to be expanded of metal, rubber c

Casting ring is available in different sizes used for single casting and partial denture casting.

Liner is this is done by 1.thermal expansion expansion of  
 mould. 2.hygroscopic expansion  
 Metal w 3.expansion of die

liner placed inside the casting ring to provide space for expansion.if space is not provided,distortion of wax pattern takes place



Types of liners: organic cellulose, silica alumina fibre, paper. Now a days asbestos is not used as asbestos fibre possesses potential health hazards.

3.7.5 Investing:

Investment of the wax pattern can be done by 2 methods.

1. Brush technique
2. Vacuum technique

Vacuum technique is better as incorporation of air bubbles is minimised. But this requires special mixing bowl and vacuum attachments.

**Brush technique:** more commonly used

- The investment material is selected.
- Casting ring is selected and the liner is placed in the casting ring. The liner is cut to size and placed in the casting ring without any overlap or gap.
- Wax pattern is wetted using wetting liquid
- Investment material is mixed. Correct W/P ratio is followed.
- Mix is vibrated to remove air bubbles and then poured along the side of the ring while gently tapping.
- When mix reaches level of wax pattern, pouring is stopped.
- A brush is used to coat the wax pattern with investment. All surfaces including the inner surface are wetted by the mix
- The rest of the ring is filled with investment material and the ring is allowed to set.
- If hygroscopic expansion is to occur, then the ring is allowed to set under water,
- The ring after the investment material sets is ready for burnout.

**Assessment activities:** Video presentation-quiz/discussion based in this

Visit to dental lab. Report presentation on the procedures witnessed.

Detailing of practical: spotters-identification of materials and equipment

**Sample questions:**

- 1) Identify the role of the following
  - a. liner
  - b. sprue
  - c. reservoir

- 2) You are given a wax pattern of a crown on maxillary canine.  
Write the detailed procedure of investing the wax pattern from the step spruing
- 3) Give reasons for the following procedures
  - i) Using reducing zone of the blowpipe flame for melting alloy
  - ii) Placement of sprue on the thickest portion of wax pattern.
- 4) a. Purpose of investing in casting procedures  
b. List any two investment materials
- 5) Identify which is better from those given below. Justify your answer
  - a. spruing done with reservoir or without reservoir
  - b. investing with liner or without liner
- 6) Draw a diagram showing the cross section of casting ring with an invested wax pattern and label its parts.
- 7) Classify investing material according to its indications.
- 8) List down the principles of spruing
- 9) Name the materials you use for the following procedure  
Investing of wax pattern  
Spruing
- 10) Identify the purpose of placing liner in a casting ring.
- 11) Identify the reasons for the following
  - a) Placement of liner
  - b) Placement of sprue in the bulkiest portion of the wax pattern
  - c) Placement of reservoir
- 12) During investing a X is attached the wax pattern
  - a) Identify X
  - b) Write the principles of its attachment.
  - c) What are the materials of which X is made up of.
- 13) Identify which is better and justify your answer.  
Spruing done with reservoir or without reservoir

## UNIT 3.8

## Burn Out

Burn out is the process of heating the casting ring so as to melt the wax and create a mould. Following the correct procedure is essential to eliminate the wax totally and to create the perfect mould. This unit also deals with alloy shrinkage and methods to compensate for it.

**Learning outcomes:** The learner

- compensates for alloy solidification shrinkage
- Assists in performing burn out procedure adequately

### Unit in detail

#### 3.8.1 Alloy solidification shrinkage:

The shrinkage of metal alloy as it cools down and solidifies is called alloy solidification shrinkage. This causes change in shape and size of casting.

Alloy solidification shrinkage is compensated by

- Expansion of mould
- Expansion of die

Expansion of mould: this is accomplished by

1. Hygroscopic expansion: Expansion of the investment material when it sets under water.
2. Thermal expansion: Expansion of investment material when the casting ring is subjected to high temperature.

Expansion of die: The die material which has high expansion on setting is used. Eg: when type V gypsum product is used, the resultant die will be bigger than original size of die.

#### 3.8.2 Burn out procedure

- After investment material is set, the crucible former is removed.
- The ring is cleared of all loose material.
- Then, it is placed in a furnace with sprue side down.
- The furnace is heated at 200°C for 30 mts.
- The entire wax evaporates leaving behind an empty mould.

- Heating is continued till the casting is completed as cooling and reheating will cause defects in casting.

**Assessment activities:**

- Report on the video presentation.
- Quiz or questionnaire based on the Video presentation
- group / general discussion
- Quiz/questionnaire

**Sample questions:**

1. You know that metal shrinks on cooling. Identify the steps taken in casting procedures to compensate for this shrinkage
2. Identify the purpose of Burnout..
- 3) Write in detail about the procedure of burn out
- 4) Identify two methods to compensate solidification shrinkage of alloys
- 5) After effects of solidification shrinkage.

## UNIT 3.9

### Casting

The procedure of melting the alloy and injecting it into the mould is called casting. The unit deals with the procedure of casting and different kinds of casting machines

**Learning outcomes:**

The learner



*Centrifugal casting machine*



*Induction casting machine*

- identifies different types of casting machines

chines accurately

- assists in melting the alloy using the correct procedure
- assists in dental lab during casting procedures

### Unit in detail

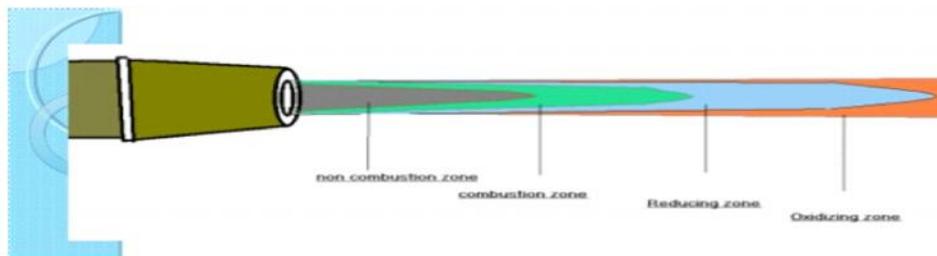
#### 3.9.1 Casting machines:

After Burnout, the ring and the mould is ready for casting. The mould is ready for casting. The mould is filled with molten metal to get the casting in the next step. The filling of the molten metal under pressure is done with the help of casting machines.

Casting machine is a device that has a heat source to melt the alloy and casting force to fill the mould.

#### Two types:

1. Casting machine in which alloy is heated with a flame torch
  - a. air pressure casting machine
  - b. centrifugal casting machine
2. Casting machine in which alloy is heated electrically
  - a. spring wound electrical resistance casting machine



*Zones of flame*

#### b. vacuum assist casting machine

**Centrifugal casting machine:** This kind of machine is the most advantageous. It consists of a rigid base to which a pivot is attached with the two arms at the upper end of the pivot. The casting ring and the mould plus crucible is placed in the one arm. The metal is melted in the crucible. The casting machine utilises centrifugal force for filling up the mould.

The alloy is melted in a ceramic crucible. When the alloy is melted the casting ring is placed and the pin is released. When the machine starts spinning, the molten alloy in the crucible is directed towards the casting ring and the mould is filled up.

**Casting crucibles:** This holds the alloy during the melting process till it is completely cast.

#### **There are 3 types:**

- clay crucible
- Ceramic crucible
- Carbon/graphite crucible

### **3.9.2 Melting of alloy**

The alloy is melted by heating it in a crucible with a blowpipe. The fuel used is a mixture of natural or artificial gas and air. The flame used should have distinguishable zones. The zones are as follows:

**Dark zone:** Zone where air and gas gets mixed. There is no heat present in this zone.

**Combustion zone:** greenish in color.it is an oxidising zone. Not used for melting the alloy

**Reducing zone:** dim blue reducing zone. Hottest parts of flame. This zone is kept constantly in contact with alloy.

**Oxidising zone:** The outermost zone. Temperature is less than that of reducing zone

### **3.9.3 Casting of metal:**

The casting machine is cleaned and readied for casting

Proper crucible is selected.

- The casting machine is given 3-5 turns and locked in position.
- Torch is lit with proper fuel.
- Regular alloys-combination of air and gas
- Metal ceramic alloys- combination of gas and oxygen
- The crucible is preheated to avoid excessive slag formation.
- Flux is added for gold alloys.
- The alloy is placed on one side of the crucible to enable the proper observation of alloy
- The reducing zone is made to contact the alloy to start the melting procedure.
- The casting should be done immediately when the proper temperature is reached.
- The ring is removed from the burnout furnace and placed in the cradle of the casting machine. The arm of the casting machine is released.
- The arm is allowed to spin and slow down
- The ring is removed.
- After the red glow subsides it is quenched in water.

**Assessment activities:** Video presentation on the casting procedure. A general discussion on the melting of alloy and casting of metal.

Quiz or questionnaire based on video presentation

Detailing of practicals: spotters

**Sample questions:**

- 1) Study the picture given below and identify the labelled parts, (picture of the zones of flame given)
- 2) What are the types of casting machines? Identify the most suitable of casting machines.
- 3) Suggest an ideal casting machine with its advantages.
- 4) What are the different types of crucibles.
- 5) List armamentarium for casting.
- 6) Identify the different zones of flame.
- 7) Ideal zone of flame for melting of alloys. Justify your answer.

## UNIT 3.10

### Divesting And Finishing

Divesting is the procedure of recovering the casting from the casting ring after casting procedures have been completed. This unit deals with the procedure of removal of casting from the investment safely. Another important procedure dealt with in the chapter is pickling. The unit also deals with the finishing procedures mainly trimming and polishing of casting.

**Learning outcome:** The learner

- assists in performing divesting procedures adequately
- assists in performing the pickling procedures accurately
- assists in trimming and polishing the finished casting appropriately

#### Unit in detail

##### 3.10.1 Divesting:

The procedure of removing the casting from the investment after successful completion of casting procedure is called Divesting

Procedure: After the arm of the machine slows down and stops the casting ring is left in the machine till the red glow disappears

- It is then quenched by plunging in water.
- In gypsum bonded investment the investment disintegrates while quenching
- In phosphate bonded investment, it is trimmed in the area of crucible former and then the entire investment is pushed out with the thumb.
- " The recovered casting is dark because of a layer of oxides on the surface. This oxide layer is removed from the surface by a process called pickling

##### 3.10.2 Pickling:

Process of heating the discoloured casting in an acid solution to remove the oxide layer.

The solution used is 50% HCl or H<sub>2</sub>SO<sub>4</sub>. The casting is placed on a dish and the acid is poured over it. This is then heated. Boiling is avoided. After the process, the acid is poured and the casting is removed. The casting is ready for finishing and polishing.

### 3.10.3 Finishing and polishing:

Once the casting is free from oxides and any defects, finishing and polishing is done.

Principles: Any distortion to the casting is avoided. The anatomy of the casting should be preserved

High speed is applied rather than low speed as it is more effective,

Excessive pressure during polishing should be avoided as this generates heat

Clean polishing wheels should be used.

**Procedure :** The sprue is removed with a separating disc. Care is taken not to damage the essential parts of the casting.

- Sprue stub is grinded off with the help of a stone. The casting is then roughly grinded with the same stone.
- Grinding is finished with barrel shaped stone with medium grit.
- Fine grit paper is applied on the entire casting
- Sand paper rubber wheel is applied to remove all surface scratches
- Final polishing is done with polishing agents and buffing compounds.
- Finally a cloth buff or leather buff is employed to the casting to get a smooth shiny finish.

**Assessment activities:** demo/video presentation.

Report on visit to dental lab

Notes evaluation

Detailing of practical: spotters-identification of materials and equipments of divesting and finishing

#### **Sample questions:**

- 1) The casting when removed from the casting ring has a blackish discoloration on the surface.
  - a. Identify the reason for the discoloration
  - b. How do you rectify this defect?
- 2) Identify the reasons for the following procedures
  - a) Pickling
  - b) Finishing of casting

- 3) Identify the term 'divesting'
- 4) Purpose of pickling
- 5) Principles of finishing and polishing of cast restorations
- 6) Purpose of finishing and polishing of cast restoration
- 7) List any two materials used for finishing and polishing of cast restorations

## UNIT 3.11

### Casting Defects

Defects or mistakes that occur during casting procedures are called casting defects. Casting defects compromise the casting aesthetically as well as functionally. As most of the casting defects occur due to the ignorance or negligence of the dental technician, knowledge of the same is essential for him to fabricate a successful casting. This unit deals with the different types of casting defects, their causes and prevention.

**Learning outcomes:** The learner

- Understands the importance of preventing casting defect and thus take appropriate steps
- Prevents distortion of casting
- Prevents surface roughness and irregularities
- Prevents porosity
- Take adequate steps to prevent this defect

#### **Unit in detail**

##### **3.11.1 Consequences of casting defects**

- Loss of time
- Wastage of material
- Damages reputation

##### **3.11.2 Distortion of casting**

Change in size or shape of casting is called distortion of casting

##### **3.11.3 Surface roughness and irregularities.**

Isolated areas of roughness, nodules or irregularities. These are areas of surface porosities

##### **3.11.4 Porosity**

Casting defect	Causes	Prevention
<p><b>Distortion of casting</b></p> <p><b>1. poor fit casting:</b></p> <p>a. too large casting</p> <p>b. too small casting</p> <p><b>2. distortion of casting:</b></p>	<p>a. increased expansion of mould due to high temperature during wax elimination</p> <p>b. using investment with high expansion</p> <p>a. decreased temperature leading to decreased expansion of mould</p> <p>b. decreased flow of metal due to decreased force</p> <p>c. casting liner not kept</p> <ul style="list-style-type: none"> <li>- inadequate expansion</li> <li>- contraction of mould</li> </ul> <p>a. distortion of wax pattern due to thermal changes</p> <p>excess manipulation of wax</p> <p>formation of stress due to manipulation of wax</p> <p>b. due to uneven expansion of investment</p> <p>c. due to pushing of wax pattern during investing</p>	<p>Use of correct temperature</p> <p>Use of correct investment material</p> <p>Adequate temperature to be maintained</p> <p>Adequate casting force to be given</p> <p>Casting ring to be kept</p> <p>Wax should be softened not melted</p> <p>Avoid wax addition to already solidified wax</p> <p>Maintain pressure till wax is rigid or cooled</p> <p>Proper mixing of investment</p> <p>Using thin mix of wax</p>
<p><b>surface roughness and irregularities</b></p>	<p>Air bubbles</p> <p>Water film</p> <p>Under heating</p> <p>Water powder ratio</p>	<p>Air should be eliminated.</p> <p>Wetting agent applied on wax pattern</p> <p>Wetting agent applied</p> <p>Correct temperature should be applied</p> <p>Proper water-powder ratio should be maintained</p>

Casting defect	Causes	Prevention
	Prolonged heating Foreign bodies Improper casting pressure	Avoid prolonged heating Clean wax pattern before investing Maintain proper casting pressure
<b>Porosity</b> There are different types of porosity <b>1. porosity due to solidification shrinkage</b> a. localised shrinkage porosity b. suck back porosity c. micro porosity <b>2. porosity due to gases</b> Occurs due to gas trapped in alloy material	Incomplete filling of mould Lack of molten metal during solidification due to Thin sprue No reservoir Reservoir far from pattern Due to solidification of reservoir before solidification of restoration Due to rapid solidification of alloy due to low temperature of mould Excessive heating of metal	Adequate sprue Reservoir kept at adequate distance from pattern Maintain temperature of mould Do not overheat the metal Control the rate at which metal enters the mould

Casting defect	Causes	Prevention
a. subsurface porosities b. gas inclusion porosities c. pin hole porosities	Overheating of mould, prolonged heating ↓ Causes dissolving of gases in molten metal ↓ During solidification this gas is released and this results in minute holes	- use proper flame - preheat the metal in crucible - do not over heat the metal
3. <b>porosity due to air entrapment (back pressure porosity)</b>	Entrapment of air on inner surface of casting Use of thin sprues Dense investment Insufficient casting pressure	Complete burnout Proper w/p ratio Adequate casting pressure Proper casting force Avoid thick mix of investments Air vent usage
<b>Incomplete casting and missing details</b>	Incomplete elimination of gas Blockage of sprue Insufficient metal Viscosity of molten metal is high Inadequate casting pressure	Complete wax elimination is one Care to prevent blockage to sprue Adequate metal taken Viscosity maintained Casting pressure maintained

Detailing of practicals: Identification of all the above kinds of porosities

**Assessment activities:**

1. Presentation of chart/album depicting pictures of casting defect
2. Collection of castings with different types of casting defects
3. Quizzes and tests based on causes and prevention of porosities. The learners can be divided into groups for the quiz session. Each comes prepared with a set of questionnaire.
4. Open discussion on casting defects

**Sample questions:**

- 1) A casting you did in the lab was seen to have rough surface on the buccal surface.

Identify the reason for this defect and mention the ways to prevent them.

- 2) The casting you were given was seen to have the following defects
  - it was weak
  - it caused leakage and secondary caries
  - it caused discoloration to the restoration
  - a) Identify the defect
  - b) Mention the reason for this defect and the ways to prevent this defect
- 3) The FPD obtained after casting was found to have surface roughness and irregularities. State the reasons and ways of preventions.
- 4) List down the different casting defects, causes and prevention in a tabular column.
- 5) What is suck back porosity?
- 6) One type of casting defect causes the following effects.
  - Casting gets weak
  - Causes leakage and secondary caries to tooth
  - Discolouration of restoration
  - a) Identify the casting defect.
  - b) Name the different types of this defects and the precautions to be taken to avoid this defect

- 7) Identify the cause of the following casting defects
  - a) Poor fit of the casting
  - b) Distortion of the casting
- 8) How can we prevent the occurrence of surface roughness of casting
- 9) Identify the possible causes of casting
- 10) State the reason behind the fact that the wax pattern should be invested immediately

## UNIT 3.12

### Fabrication Of Ceramic Crown

Ceramic or porcelain crown is the most popular of all artificial crowns as they are superior in aesthetics to metal and acrylic crowns. Ceramic and porcelain crown are used synonymously as porcelain is a material that belongs to the ceramic family. Translucency, light transmission and biocompatibility give dental ceramics highly desirable aesthetic properties. Dental porcelain is essentially glassy, non-metallic material which are used for making denture teeth and fixed partial dentures. This unit deals with the procedure of fabrication of porcelain/ceramic crown. It also explains the composition and properties of ceramic material and the ideal method of manipulation.

**Learning outcomes:** The learner

- Manipulates the material accurately
- Identifies different types of material
- Chooses the ideal material
- Assists in fabrication of dental ceramic crown

#### Unit in detail

##### 3.12.1 Dental ceramic

- composition of material.

The main constituents are feldspar, quartz, kaolin

- Composition- feldspar-basic constituent, 60-80%  
Kaolin -binder, 3-5%  
Quartz -filler, 15-25%

Alumina-glass former, 8-20%

Boric acid-glass former and flux, 2-7%,

Oxides of sodium, potassium and calcium- glass modifiers, 9-15%

Metallic pigments-for acquiring desired tooth shade, less than 1%

- Advantages of material
  - Excellent aesthetics
  - Biologically compatible
  - Impervious to oral fluids
  - Chemically indestructible in moist conditions
- Properties of material-
  - Brittle
  - Low tensile strength
  - Fractures easily
  - Low fusing temperature
  - High viscosity
- Mode of supply -supplied as a kit containing
  - Fine ceramic powder
  - Liquid or distilled water
  - Stains or colour modifiers
  - Glaze

Chart preparation on the properties and composition of material

### 3.12.2 Classification of dental ceramic

Classification is done in many ways

- **according to use**
  - a) construction of artificial teeth
  - b) Fabrication of jacket crown and inlays
  - c) as veneers over cast metal restoration

- **according to temperature of firing**
  - a) High fusing 1290-13700C
  - b) Medium fusing 1095-12600C
  - c) Low fusing 870-10650C
- **according to method of firing**
  - a) air fired
  - b) Vacuum fired
- **according to application**
  - a) Dentine or body porcelain
  - b) Enamel porcelain

### 3.12.3 Steps in fabrication

Four basic steps in fabrication of ceramic crown are condensation, firing, glazing and cooling

**Condensation-** mixing and application of ceramic material in prepared die to form tooth structure. This step packs the material in a dense form.

Types of condensation:

- Brush method
- Vibration method
- Spatulation method

**Procedure:** a master cast with removable dies are constructed after taking impression

Trim the dies and block undercuts

Apply cement spacer/die spacer

For jacket crown fabrication, a metal foil is adapted over the prepared tooth

- **Condensation** The ceramic is built on this metal foil. Any of the above condensation method is used.

Rapidly apply the material and carve it to the desired shape. Ceramic is taken according to the shade of the tooth. Darker shade is used in the cervical region and translucent is used in the incisal area. The build-up area is dried with a napkin.

- **Firing-** this ceramic mix is fired under high temperature any trace of moisture is removed from the mix before firing. Moisture will cause the mix to fracture

**First bake:** the furnace is heated to app.5390C.The crown is placed in the furnace and the temperature is increased to the fusion temperature of the ceramic used.

**Cooling-** After the fusion temperature is reached the crown is placed in a glass dome so as to facilitate the cooling slowly. The crown has a matt finish.

When cold the crown is replaced on the die and any changes are incorporated. Stains are added at this juncture. The crown is compressed and placed back in the furnace for the second bake.

**Second bake:** The temperature is raised till the ceramic is fused to a dull glaze. Then it is removed and cooled. It is then trimmed and ceramic dust is blown off from the crown. It is then scrubbed with cleaning powder mixed with water and wiped clean. Then it is rubbed with porcelain powder.

- **Glazing-**the crown is fused to the desired glaze
- **Cooling-** The crown is cooled slowly to normal temperature.

**Assessment activities:** Groupdiscussiononsteps of fabrication.

Questionnaire /quiz based on the video presentation

Detailing of practicals: Identificationof steps of fabrication.

Spotters

### Sample questions:

- 1) Dental porcelain is superior to resins in the fabrication of crown and bridge especially in the case of anterior teeth. Justify
- 2) Write the step by step procedure you will undergo for fabrication of a ceramic crown. You have been given a die of the tooth on which the crown has to be manufactured.
- 3) 'X' is a glassy material used for making denture teeth, single unit crowns, labial veneers.
  - a) Identify X
  - b) What is the composition of X
  - c) Write the advantage of X over other material
- 4) Identify the reason ofgreen discolouration of porcelain.

- 5) Classification of casting alloys
- 6) Identify the requirements of casting alloys
- 7) Crown and bridge alloys.

## UNIT 3.13

### Materials Used In Casting Procedures

This unit deals with the materials used during casting procedures. The composition, properties and manipulation of the materials is discussed in detail. Knowledge of the properties and composition of the material will help the learner to make use of the material adequately

**Learning outcome:** The learner

- Manipulates investment materials adequately
- Chooses the investment material according to the type of casting
- Chooses the ideal alloy for casting
- Chooses and manipulates the material adequately
- Chooses and uses materials adequately

#### Unit in detail

##### 3.13.1 Investment materials.

An investment material can be described as a material suitable for forming a mould into which a metal or alloy is cast

**Ideal requirements:**

- 1) It should have a composition and consistency to produce a smooth surface.
- 2) It should be easily manipulated
- 3) It should have sufficient overall expansion
- 4) Should have adequate strength at high temperatures.
- 5) Should be economical

All investment materials have the same basic constituents.

- 1) Refractory substance: e.g.; silica

This material can withstand high temperatures without decomposing

2) Binder: to bind the refractory substance together

E.g.: Alpha hemihydrate-for dental casting alloys

Co-cr alloys- sodium silicate, methyl silicate, ammonium sulphate and sodium phosphate.

3) Modifiers: materials used in small quantities to modify the physical properties

E.g.: sodium chloride, boric acid, potassium sulphate, graphite

**Types of investment:**

1) Gypsum bonded investment

2) Phosphate bonded investment

3) Silica bonded investment

Gypsum bonded investment

Used for casting alloys. Can be heated up to 700°C. 3 types

Type 1- casting of inlays and crowns. Alloy shrinkage compensation by thermal expansion

Type 2- casting of inlays and crowns. Alloy shrinkage compensation by hygroscopic expansion

Type 3 construction of partial dentures with gold alloys

**Composition:**

1) Refractory material: silica

2) Binder -dental stone

3) Chemical modifiers

Silica: quartz and cristobalite.

It regulates thermal expansion. It also provides for mould expansion

Gypsum -dental stone

It acts as a binder for silica. It also gives strength to the mould.

Chemical modifiers: It regulates setting expansion. It also prevents shrinkage of gypsum.

Phosphate bonded investment: This investment is used for casting metal ceramic restoration and cast partial dentures. These alloys have high melting points. At these high temperatures, gypsum bonded investment will disintegrate. Phosphate and silica

bonded investment can withstand high temperatures and are used for this purpose.

**Composition:**

1. refractory material: silica
2. binder -MgO and a phosphate

Magnesium oxide reacts with the phosphate ion.

Ammonium di acid phosphate-It increases strength at casting temperature. It is soluble in water. It gives strength at room temperature.

Silica bonded investment: Ethyl silicate or colloidal silica used. Silica bonded is used for the same purpose as phosphate bonded.

**3.13.2 Alloys used in casting procedures:**

A pure metal is a material composed of one metallic compound only

Alloy is a material composed of two or more metallic elements.

**Classification:**

I Noble metal alloys

- a . casting gold alloys
- b . white gold alloys

II Base metal alloys

- a. Co-Cr alloys`
- b. Wrought metal alloys

Noble metals are gold, platinum, palladium, iridium, osmium, rhodium, and ruthenium

a. Casting gold alloys:

They are used for casting purposes.eg: construction of inlays, crowns, bridges and dentures.

**Casting gold alloys are classified as**

1. Based on the karat number :

Karat refers to the parts of pure gold in 24 parts of the alloy

E.g.; 24 karat-pure gold alloys

22 karat-22 parts gold +2 parts other alloys.

2. Based on fineness of gold

Fineness is the number of parts of gold in 1000 parts of an alloy or % of gold multiplied by 10.

E.g.: if gold % is 75. The alloy is considered 750 fine.

3. Based on percentage of gold (Most universal)

Type I: Gold - 83% gold soft

Type II: Gold - 77% gold harder than type I

Type III: Gold - 75% gold Harder than type II

Type IV: Gold - 69% gold Hardest

**Functions:**

Type I Soft. Used in situations where high stresses are not experienced.

Type II Harder than type I. has more Cu and Ag. Used for making inlays and its properties are not altered.

Type III Used in high stress situations. Used in making bridges.

Type IV Extra hard. Used for partial dentures and clasps.

**Composition:-**

Au, Ag, Pt., Pd and Zn

Au - basic constituent. Prevents corrosion.

Ag and Cu - superior mechanical properties.

Pt. and Pd - prevents corrosion of alloy.

Zn - scavenger. Removes oxygen.

Medium and low gold alloys: mainly to reduce the cost of gold alloys - gold content is decreased to 58% and then 40%. This increases hardness of alloy, but the resistance to corrosion is not so good.

White gold alloys

They are gold based alloys having a silver colour.

Ag - 35-66%

Au - 30%

Pd - 10-35%

Cu - 6-25%

Not used presently.

### **Base metal alloys**

They consist of non-noble metals. They have a positive influence on the physical properties of the alloy. They strengthen the alloy. They prevent alloy corrosion by passivation.

Base metals are:

Ni, Cr, Co, Al, Mo, Si, Be, Mn, Fe and Sn.

### **Classified as:**

- a. Crown and bridge alloys
- b. Metal ceramic alloys
- c. Partial denture alloys.

Cobalt-Chromium alloys

Co-Cr and Ni-Cr are two most important alloys in dentistry. Co-Cr alloys are also called Vitallium alloys.

Properties: strong, hard, bright, silvery white, non-tarnishing qualities.

### **Applications:**

1. Denture base
2. Cast and denture framework
3. Surgical implants.

### **Composition:**

Co - increase hardness and give white-silver colour.

Cr - High corrosion resistance

Ni - 0-20%

Mo - improves casting qualities

Fe - 5%

C - 0.4% increases strength and decreases ductility.

Traces of Sn, Mn, Si and Pt.

### **Wrought metal alloys**

They are base metal alloys and are used in dentistry for

1. Stainless steel alloys
2. Co-Cr-Ni
3. Ni-Ti
4. Beta - Titanium

**Stainless steel:** steel is a Fe-Cr alloy. This is highly susceptible to corrosion. When Cr, Ni are added, it becomes stainless steel. Cr and Ni improve the corrosion resistance by the formation of an oxide layer on the metal surface.

#### **Types of stainless steel**

1. Ferritic stainless steel
2. Martensitic stainless steel
3. Austenitic stainless steel

**Ferritic stainless steel:** good corrosion resistance; less strength and hardness; less application in dentistry

**Martensitic stainless steel:** Less corrosion resistance; high strength and hardness; used for surgical and cutting instruments.

**Austenitic stainless steel:** (18/8 steel) most corrosion resistant alloy of stainless steel. Composition, Cr (18%), Ni (8%) and C (0.08 - 0.15%).

Therefore it is called 18/8 steel.

#### **Uses**

- Used in orthodontic wires and bands
- Greater ductility
- Ability to undergo cold working without breaking
- Greater ease of welding

**Sensitisation:-** Loss of resistance to corrosion if it is heated between 4000C-9000C due to precipitation of chromium carbide at grain boundaries.

#### **Stabilization :-**

- process of reducing sensitisation
- one method is by decreasing carbide content. No economically predictable.
- Second method is by introducing Ti. This inhibits the precipitation of Cr Carbide at soldering temperatures.

### 3.13.3 Model, die and cast preparation

A model or cast is a positive copy of the teeth and associated structure which are contained from an impression.

A die is a positive copy of a single tooth contained from an impression. Dies are mainly used in the construction of inlays, crowns, and bridges.

#### **Requirements of a die material**

1. it should have high strength and surface hardness.
2. It should reproduce fine details contained from an impression.
3. It should be dimensionally stable.
4. It should have good surface, which is resistant to abrasion
5. It should be compatible with all the impression materials.
6. It should be economical.
7. It should be easy to manipulate.
8. It should allow burnishing of foil and resist breakage
9. It should possess a contrasting colour with wax, porcelain and alloys.

#### **Types of casts and die materials:**

1. Gypsum
  - a. type 4-dental stone with high strength
  - b. type 4 - dental stone with high strength and gypsum hardener
2. Metal
  - a. electroformed silver die
  - b. sprayed metal
  - c. amalgam
  - d. electroplated copper
3. Polymers
  - a. metal filled resin
  - b. epoxy resins
4. Cement-silicophosphate or polyacrylic acid bonded cement
5. Ceramic - for direct backing of porcelain crowns

**Advantages of die materials:**

**Gypsum:**

- it has good strength
- It has good working time
- it is compatible with all impression materials
- possess minimal shrinkage
- quick setting
- smooth and hard surface
- can be easily trimmed
- has good colour contrast
- economical

**Disadvantages of die materials:**

**Gypsum**

- The material is brittle
- The edge strength is low. So, occlusal surface can be rubbed off on repeated contact

**Polymers**

- They shrink on polymerisation. The die they produce will be smaller than the original

**Cements**

- They shrink slightly, so dimension of die changes
- They are brittle, so they get damaged during wax pattern fabrication
- They have a tendency to crack due to dehydration

**Metal dies**

- Some metal dies are soft and require careful handling to prevent abrasion of die

**Amalgam dies**

- method of preparation of amalgam die is time consuming.
- it has to be condensed skillfully. Improper condensation can lead to significant dimension changes.

**Electroplated dies**

Advantage over other materials

- more surface hardness

- better resistance to abrasions
- superior surface details

**Disadvantages:**

Silver cyanide solution is extremely dangerous if it contacts acid as it produces extremely toxic hydrocyanic acid. So the bath is placed in a well-ventilated area and avoids use of acids near the bath

Silver plated dies are only more or less as accurate as stone dies. There is more chances of distortion of impression during electroplating. So, the advantage of electroplating is compromised.

**Resin vs. Dental stone:**

- Resin is more prone to trap air bubbles
- resin is more viscous than dental stone
- resin resists abrasion more effectively than dental stone.
- have higher compressive strength than dental stone.

**3.13.4 Abrasives and polishing materials**

Abrasives are substances that can be used to grind and polish a surface. Abrasives give the substance its desired shape and size. The particles of abrasives are bigger and harder and rough.

Polishing agents are substances used to provide a smooth and shiny surface on a substance. The particles of a polishing agent are smaller and smoother.

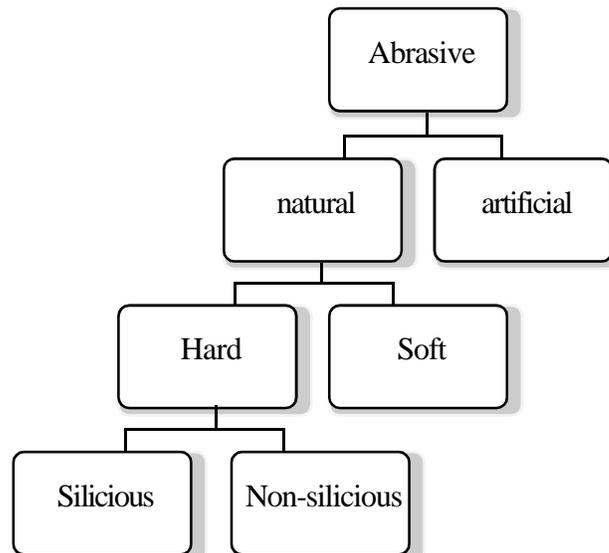
**Polishing agents provides**

- a surface that is aesthetically good
- Provide comfort to the patient as they reduce undercuts as well as rough edges.

Polishing prevent adhesion of food debris, saliva and plaque on the dentures.

If restorations/dentures are not polished properly -

- They become dirty easily--cleaning becomes difficult.
- They become prone to tarnish & corrosion.
- Aesthetics is compromised
- Oral hygiene is compromised
- Prevention of tarnish and corrosion



### **Natural Abrasives**

- a. Siliceous Abrasives :- contains silica  
E.g.: quartz, flint, graphite
- b. Non-siliceous abrasives: - They do not contain silica.  
E.g.: Diamond, corundum, emery

### **Artificial Abrasives**

Eg: silicon carbide/carborundum. Boron Carbide. Aluminium Carbide.

Abrasives and polishing agents used in dentistry.

	Materials	Abrasive	Polishing agent
1.	Carborundum	Grinding teeth and metal	Polishing agent
2.	Sand	Preparing denture for polishing and sandblasting	--
3.	Emery	Used on metals	--
4.	Tungsten carbide	Removing rough edges from resin dentures	--
5.	Silicon carbide	Cutting of tooth structure	--
6.	Aluminium oxide	Used as an abrasive	
7.	Garnet	Abrasive that operates with dental hand piece	
8.	Pumice	Used as an abrasive	Used as polishing agent on resin dentures
9.	Kieselguhr	Mild abrasive	Polishing agent in oral cavity
10.	Tripoli	Mild abrasive	Used as polishing agent
11.	Diamond	To abrade tooth material in oxide	--
12.	Rouge		Excellent polishing agent for gold and noble metals
13.	Tin oxide		Used for teeth and metallic restorations
14.	Whiting or precipitate chalk		Used for resin dentures
15.	Chromium oxide		Final polishing for stainless steel and gold

**Assessment activities:**

- Chart preparation on classification of abrasives
- Group discussion on types of abrasives and polishing agents
- Seminar on the same

**Sample Questions:**

- 1) Uses of gold alloys in dentistry
- 2) Identify the importance of the following:
  - a) finishing and polishing
  - b) Use of phosphate bonded investment in casting metal ceramic restorations.
- 3) Abrasives are materials used for finishing of restorations.
  - a) Classify abrasives.
  - b) Identify abrasives commonly used in dentistry .Specify the role of each.
- 4) Identify and explain the following terms
  - a) Sensitisation
  - b) stabilisation
- 5) Advantages of centrifugal casting machine
- 6) Advantage of 18/8 stainless steel
- 7) Why 18/8 stainless steel said to be corrosion resistance
- 8) Classify stainless steel.

## UNIT 3.14

### Tarnish And Corrosion

This unit deals with tarnish and corrosion, definition, and types of corrosion.

**Learning outcomes:** The learner

- identifies the ideal metal alloy that can resist corrosion
- identifies conditions that cause various types of corrosion

#### Unit in detail

##### 3.14.1 Tarnish and corrosion

Tarnish is defined as the surface discolouration of metal or slight loss of finish or lustre.

Corrosion is defined as the deterioration of metal by reaction with environment.

#### Types of corrosion:

1. Chemical corrosion (dry corrosion)
2. Electrolyte corrosion (wet corrosion)

Chemical corrosion: direct combination of metallic and non-metallic elements occurs in the type of corrosion.

#### Examples:

- Discoloration of silver by sulphur
- Oxidation of alloy particles in dental amalgam.

Electrolyte corrosion: the corrosion that takes place when there is dissimilar metals present in the oral cavity. Saliva acts as a weak electrolyte. The corrosion products will be at the anode.

Galvanic corrosion: occurs in the oral cavity in the presence of dissimilar metals and saliva will act as a weak electrolyte. When the metal restoration comes in contact, galvanic current formation occurs.

#### Result

1. If the current passes through the pulp the patient experiences pain.
2. Corroding of metal surfaces occurs. Pitting and roughness of metal crown occurs.

**Occurs when:**

- a. 2 dissimilar metals meet in oral cavity in the presence of saliva.
- b. When a patient with amalgam filling chews on a chocolate foil.

**Assessment activities:** Data collection on different types of corrosion

Analyse and categorise the different dental prosthesis made of alloys

Group discussion factors affecting corrosion in dentistry

Notes evaluation

**Sample questions:**

- 1) Differentiate between
  - a) Galvanic corrosion
  - b) Chemical corrosion
  - c) Stress corrosion
- 2) You know that the deterioration of metal is called "corrosion". According to you how is corrosion significant in dentistry? Also give an example of corrosion occurring in oral cavity.
- 3) Define and give examples from dentistry
  - 1) Tarnish
  - 2) Corrosion
- 4) Identify the following
  - a. discoloration of metal
  - b. deterioration of metal under stress
- 5) The presence of metallic restoration in the mouth can cause a phenomenon called galvanism.
  - a) Explain briefly this phenomenon
  - b) Illustrate an example
- 6) Tarnish and corrosion are important in dentistry. Comment on.
- 7) I am an early indication of corrosion and corrosion is often the sequelae of myself.

- a) Who am I
- b) Identify my importance in dentistry
- 8) Identify the preventive measures of tarnish and corrosion occur in a dental restorations and appliances.
- 9) Discoloration of metal is \_\_\_\_\_
- 10) Destruction of metal is \_\_\_\_\_

### **EXTENDED ACTIVITIES:**

Posting of learners to dental laboratories on weekend basis. A report on the procedures they have witnessed is assessed.

The learners can participate in dental camps organised by IDA. Getting involved in the organisation of the camps will give them an insight to the administrative side. They will also witness different patient cases.

Visit dental laboratories and compile a report on the casting defects and the methods of prevention. This exposes the learner to various practical methods adopted by the laboratories in preventing casting defects

The learners are divided into groups and asked to go on house visits .A study on the common dental problems in a particular area can be assessed. The learners can also motivate the public to treat the dental problems.

### **LIST OF PRACTICALS**

#### **Unit 3.1 Designing FPD-suggest number of unit**

**Identification of various components of fixed partial dentures**

#### **Unit 3.2 Identification of different types of finish lines on the cast**

#### **Unit 3.3 Identification of materials used in cast duplication**

#### **Unit 3.4 Identification of materials used in die preparation**

#### **Unit 3.5 Fabrication of wax pattern for jacket crown on central incisor**

**Fabrication of wax pattern for jacket crown on canine**

**Fabrication of wax pattern for jacket crown on 1st molar**

- Unit 3.6 Identification of different types of pontic**
- Unit 3.7 Identification of different types of materials used in investment**
  - Fabrication of sprue on wax pattern**
- Unit 3.8 Identification of materials used on wax pattern**
- Unit 3.9 Identification of different types of casting machines**
- Unit 3.10 Identification of materials used in divesting and finishing**
- Unit 3.11 Identification of different types of casting defects**
- Unit 3.12 Identification of materials used in ceramic crown preparation**
- Unit 3.13 Identification of various types of investment materials, alloys, die materials, finishing and polishing material**
- Unit 3.14 Identification of castings undergoing tarnish and corrosion**

## MODULE- 4

### Overview

Module 4 consists of some important and attractive units, that covers Orthodontics, lab procedures, including soldering, welding, spot welding and Dental Assistance Part II which includes awareness of dental X-ray & front office management and Chair side management of dental clinics. Orthodontics is a dynamic field as the changes are occurring very rapidly. Dental assistant when working in a dental clinic has to perform his duties at the front line of dental practice, has to help a dental surgeon while doing treatment and taking x-rays. The learner has to gain a strong foundation about the concepts of the syllabus. To accomplish our learning objectives, the learner has to be provided with learning experiences that will correlate with basic and Clinical / laboratory skills.

### UNIT4.1

#### Introduction To Orthodontics

Orthodontics is considered as the oldest speciality of Dentistry. Evidences suggest that the attempts were made to treat malocclusion as early as 1000BC .Dr.Edward Hartley Angle is known to be the Father of modern orthodontics. It is essential that a dental technician must know the concept of tooth movements and mechanism of action of different orthodontic appliances etc. In this unit the learner get introduced to the orthodontics-especially about occlusion, classification of malocclusion causes and sequelae of malocclusion etc. The learner must get an idea about the aims, objectives and needs of orthodontic treatment. The attachment apparatus or the supporting structure of tooth is called as periodontium, which consist of gingiva, periodontal fibres, cementum and alveolar bone. When a force is applied on the tooth there will be histological changes in the periodontium. For effective tooth movement, force and anchorage unit are important. For effecting tooth movement orthodontic appliances are needed. For a proper diagnosis and treatment planning During fabrication of orthodontic appliance wire bending has to be done very carefully .The efficiency of wire components directly influences the success of the appliance.

**Learning Outcomes :** The learner

- Identifies different malocclusion
- Distinguishes normal and malocclusion

- Identifies the cause and sequelae of malocclusion
- Identifies various tooth movements that occur in orthodontic treatment
- Identifies the consequences of giving uncontrolled orthodontic treatment
- Assists in the fabrication of devices like head gear.
- Identifies and categorise the different types of orthodontic appliances
- Identifies and choose the armamentarium and materials used in wire bending.
- Handles the instruments properly
- Fabricates circle, square

Wire straightening. Fabricate orthodontic cast and study models

### **UNIT IN DETAIL**

#### **4.1.1. Introduction to the Orthodontics.**

Definition of the Orthodontics -It is a branch of dentistry concerned with prevention interception, correction of malocclusion and other abnormalities of dento-facial region.

#### **Unfavourable Sequelae of malocclusion.**

1. Poor facial appearance
2. Risk of caries
3. Predisposition to periodontal diseases
4. Psychological disturbances
5. Risk of trauma
6. Abnormalities of functions
7. Temporomandibular joint problems

#### **Aims of orthodontic treatment(Jackson's Triad)**

1. Functional efficiency
2. Structural balance.
3. Aesthetic harmony

#### **The scope of orthodontic treatment**

1. Alteration in tooth position
2. Alteration in skeletal pattern
3. Alteration in soft tissue pattern

**Services offered by the orthodontist**

1. Preventive orthodontics
2. Interceptive orthodontics
3. Corrective orthodontics
4. Surgical orthodontics

**Problems Associated With Malocclusion**

The sequel of malocclusion can be psychologically, socially and functionally very harmful. Psychological depression is one of the effects of malocclusion that also affects the appearance and aesthetics of a person. Malocclusion interferes with normal growth and development and causes abnormal muscle function. Hygiene of teeth in normally aligned teeth can be maintained with ease. Teeth in malocclusion are prone to caries and periodontal problems owing to the difficulty in proper hygiene. This even cause speech defects changing the phonetics of the person. The list of problems associated with malocclusion is long; few very important ones are listed below.

- Psychological and social problems
- Poor aesthetics
- Interference with normal growth and development
- Abnormal muscle function
- Improper deglutition
- Mouth breathing
- Improper mastication
- Speech defects
- Increased caries incidence
- Periodontal diseases
- Tempromandibular joint disorder

**Reasons For Orthodontic Treatment**

The importance of normal occlusion and the harmful sequelae of malocclusion are reason enough for orthodontic treatment. The need for orthodontic treatment should have been the reason for the inception of the science of orthodontics many years ago. Orthodontic treatment should be done for the following reasons:

- To improve aesthetics
- To reduce dental caries and periodontal diseases
- To reduce susceptibility to accidents
- To correct oral habits
- To correct speech defects.

### **Occlusion, Malocclusion**

1. Occlusion - Angle defined occlusion as the normal relation of the occlusal inclined planes of teeth when jaws are closed.
2. Malocclusion - Any deviation from normal occlusion is malocclusion.

#### **Key of occlusion**

The mesiobuccal cusp of upper first permanent molar should coincide with buccal groove of lower first permanent molar.

Dr.E.H.Angle classified Mal occlusion into Class I, Class II and Class III

#### **Class I**

It is characterised by the presence of normal interarch molar relation that is mesio buccal cusp of maxillary first permanent molar occlude in the buccal groove of mandibular first permanent molar. But the patients exhibit dental irregularities such as crowding, spacing, rotation etc Sometimes the patients will also have a bimaxillary protrusion

#### **Class II**

This is characterised by the presence of class II molar relation where the distobuccal cusp of maxillary first molar occlude in the buccal groove of mandibular first molar. It is sub classified into division I and division II .

##### **Class II Division I**

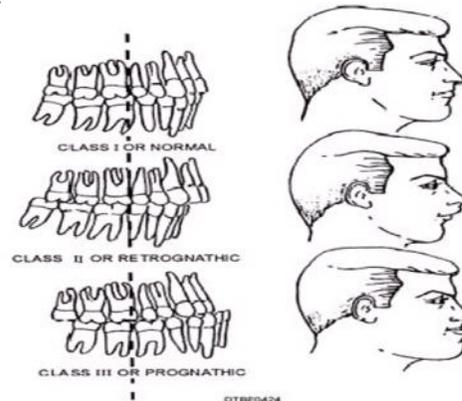
The maxillary anterior teeth are proclined with a resultant increase of overjet

##### **Class II Division II**

The Patient will have class II molar relationship with lingually inclined upper central incisors and labially tipped upper lateral incisors

### Class III Malocclusion

This malocclusion exhibit a class III molar relation with the mesio buccal cusp of maxillary permanent molar occlude in the inter dental space between mandibular first and second molar



#### 4.1.2 Tooth movement in Orthodontics.

Biomechanics, Histologic aspects of tooth movement. Stage of tooth movement, Types of tooth movement and diagrams. Pathologic changes that can occur due to uncontrolled orthodontic force.

The Biomechanics is the study of biological reactions to the mechanical forces. When a force is applied on a teeth, it results in a number of bio-physical events, Such as compressing of periodontal ligaments, bone deformation and tissue injury.

When the tooth move the periodontal ligament on the movement side will get impinged and bone destruction takes place by osteoclastic activity. On the opposite side the bone deposition occurs by osteoblastic activity. This way the socket width is maintained. The orthodontic force are 3 types: Low, Medium and high.

The high forces causes pathological changes. Such as extensive bone resorption and root resorption. Later teeth become vital. So the orthodontic force should be medium given at regular intervals.

#### Types of Tooth movement

1. Tipping
2. Translation
3. Intrusion
4. Extrusion
5. Rotation
6. Torqueing
7. Uprighting

**Tipping-** When the crown moves in the direction of force and the root moves in a direction opposite to that of the force it is called tipping movement. Tipping is the simplest of all the movements.

**Translation** - When the entire tooth moves bodily in the direction of force it is called translation or bodily movement.

**Intrusion** - When a force moves a tooth in an apical direction the movement is called intrusion.

**Extrusion** - When a force moves a tooth in an incisal or occlusal direction the movement is called extrusion.

**Rotation** - When a force rotates the tooth along its axis the movement is referred to as rotation.

**Torqueing** - Torqueing is the reverse of tipping in which the root moves lingually.

**Uprighting** - Moving a mesially or distally tilted tooth in a mesiodistal direction is called uprighting.

#### **Factors affecting tooth movement**

1. Manner of force.
  - Eg: a) Continuous
  - b) Interrupted
  - c) Functional
  - d) Intermitted
2. Amount of force.
  - a) Low
  - b) Medium
  - c) High
3. Duration of force
4. Occlusal function.
5. Age.

#### **4.1.3. Anchorage**

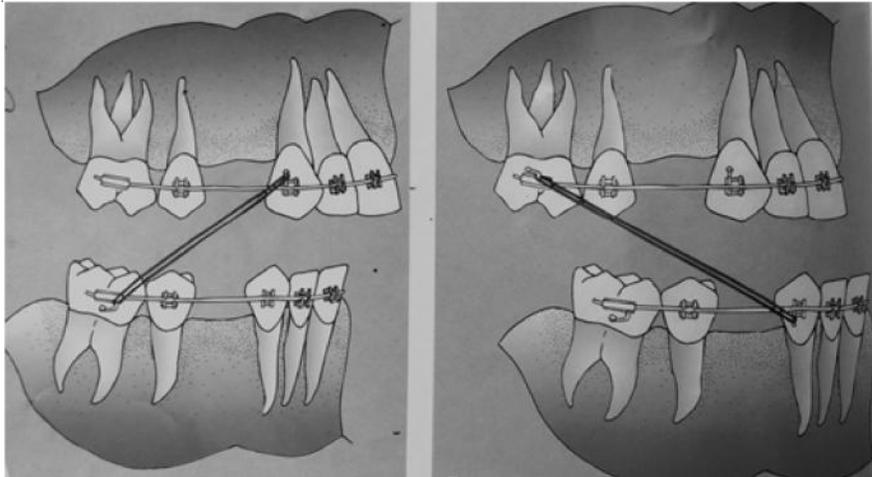
Definition, types and classification

Anchorage is the nature and degree of resistance to the displacement offered by an anatomical unit for the purpose of tooth movement.

### Classification of Anchorage.

1. Depending on the site of anchorage:
  - a) Intra oral anchorage
  - b) Extra oral anchorage
2. Depending on the manner of force.
  - a) Simple
  - b) Stationary
  - c) Reciprocal
3. Depending on the number of anchorage unit.
  - a) Simple or primary
  - b) Compound
  - c) Multiple or reinforced

### Intra Oral Anchorage



The anchorage in which the resistance units are situated in the oral cavity, Eg:- Teeth, Alveolar bone, Palate

### The intra oral anchorage is classified into two

1. Inter Maxillary
2. Intra Maxillary

### 1) Inter Maxillary Anchorage

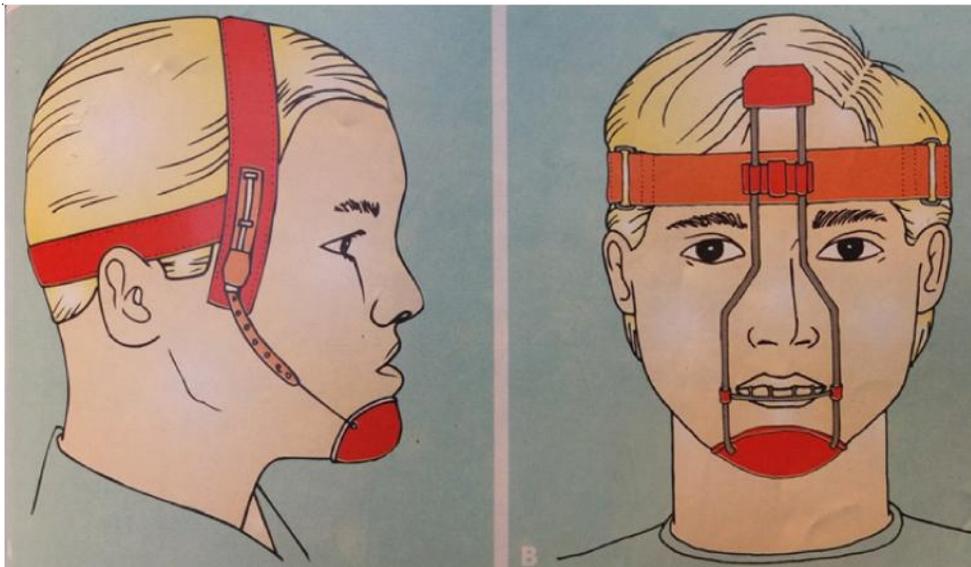
The inter maxillary anchorage is that in which resistance unit is situated in one jaw. It is used to effect tooth movement in the opposite jaw.

1. To move the maxillary teeth the anchorage unit is taken from the mandible.
2. To move the mandibular teeth anchorage unit is taken from the maxilla.

### 2) Intra Maxillary Anchorage

The intra maxillary anchorage is that anchorage unit and effective tooth movement occur in the same arch. To move the mandibular teeth the anchorage unit is taken from the mandible. To move the maxillary teeth anchorage is taken from the maxilla.

### Extra Oral Anchorage



It is the anchorage in which the resistance units are situated outside the oral cavity.

Eg:- Back of the neck, Cranium, Facial, Skull

In this case the anchorage is taken from cervical region or cranium. The face mask take anchorage from facial bone.

1. Muscular Anchorage

Muscular anchorage is taken from the force generated by muscles.

2. Simple Anchorage

In this application of force is much that it tends to change the axial inclination of the tooth and tipping movements occur.

### 3. Stationary Anchorage

In this application of force tends to displace the anchorage unit.

### 4. Reciprocal Anchorage.

Here two teeth or two groups of teeth with equal anchorage value are made to move in opposite directions.

Eg:-Reciprocal anchorage is used in case of midline diastema by moving two central incisors towards each other.

### III a) Single or Primary Anchorage

Here the distance is provided by a single tooth.

#### b) Compound Anchorage

In this resistance is provided by more than one tooth.

#### c) Re-Inforced or Multiple Anchorage

Here more than one type of resistance units are used.

## 4.1.4 Introduction to orthodontic appliance

Orthodontic appliances are used to correct malocclusions. Orthodontic appliances are devices by means of which mild pressure may be applied to a tooth or a group of teeth and their supporting structures so as to bring about necessary changes within the bone which will allow tooth movement.

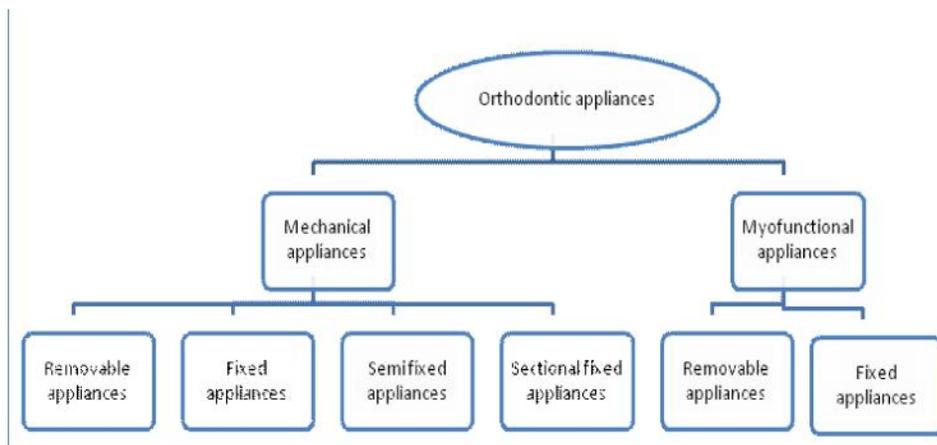
### Types of orthodontic appliances

Orthodontic appliances can be mechanical appliances or myofunctional appliances.

#### Mechanical appliances

Mechanical appliances are appliances that exert mild pressure on a tooth or group of teeth and their supporting structures in a predetermined direction with the help of active components which are part of the appliances itself. Mechanical appliances can be removable or fixed.

Myofunctional or functional appliances are loose fittings or passive appliances which harness natural forces of the orofacial musculature that are transmitted to the teeth and alveolar bone through the medium of the appliance.



#### 4.1.5 Instruments used in wire bending.

1. Universal plier - Used for making all types of bends except forming loops and coils.
2. Adams Plier - Basically for making plier
3. Loop forming plier - Basically for making loops or coil of various fix.
4. Hollow chop plier - For making bends in wires, which are already anchored at both ends in an appliance
5. Wire cutter - Used to cut wire

#### 4.1.6. Principles of Wire bending

Wire bending is an important step in the construction of orthodontic appliance. The gauge of wire component directly influence the grooves of the appliance and there by the treatment.

There are four types of bends that can be given to a S.S wire. They are soft curve, right angle bend, acute bend, Small radians bend. Pliers are used to hold wire between the beaks. They stabilize the wire while the fingers and thumb do the bending. Palm grip is employed for grasping the plier. The wire should held firmly between the beaks. But the activation of appliances is done with pliers

#### **Orthodontic study models.**

Orthodontic study models are accurate plaster reproduction of teeth and their surrounding tissues

**Uses of study models**

1. Enable the study of occlusion from all aspects
2. Help in measuring arch length, arch width and tooth size
3. Help to assess the nature and severity of malocclusion
4. Help to assess the progress of treatment
5. Help to motivate the patient
6. Help to transfer clinical records

**Ideal requirements**

1. Should accurately reproduce the teeth and surrounding tissues
2. Model should be symmetrical and pleasing to the eye
3. Should enable instant identification of asymmetries in the arch form
4. The study models are to be trimmed in such a way that when placed on their backs they accurately reproduce occlusion
5. The study model should have a clean smooth and nodule free surface
6. Should depict the tooth as well as maximum possible area of alveolar process

**Parts of Study Models**

Anatomic portion \_- It is that part of the study model which has the accurate impression of dental arch and its surrounding tissues

Artistic portion - It consist of plaster base that supports the anatomic position

**Steps Involved in the construction of study models**

1. Impression making
2. Disinfection of impression
3. Casting the impression
4. Basing and trimming of the cast
5. Finishing and polishing

**Impression Making**

A detailed alginate impression of all the teeth and supporting structures is necessary for the preparation of study models. The impression should include the entire basal bone up till the depth of labial, buccal and lingual vestibule. High flange orthodontic impression for this purpose. The impression is disinfected and washed thoroughly with water before casting.

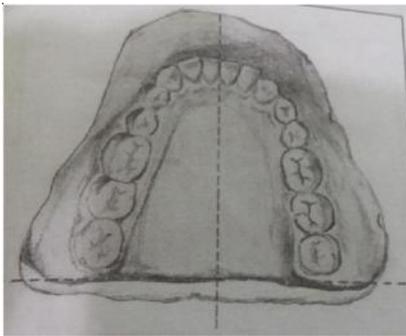
### Casting of impression

Dental stone or model plaster is mixed with water according to the manufacturer's guidelines. The mix is vibrated on a vibrator to minimise air bubbles. It is poured in the impression and vibrated again to eliminate air entrapment. After initial setting of the stone/plaster the superficial surface is roughened with a sharp instrument to enhance retention of the base. The stone cast is separated from the impression and is ready for the base preparation. This completes the reproduction of anatomic portion of model.

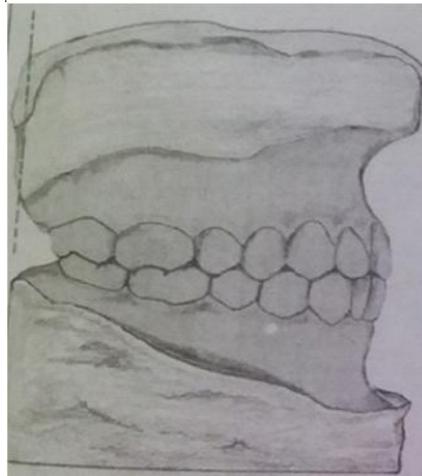
### Forming the base

Stone or plaster is mixed and placed on a smooth non-absorbent surface like glass or ceramic. The separated cast is soaked in water and placed on the mix so that the roughened superficial surface goes into the mix. The occlusal surface of the cast should lie approximately parallel to the surface of the glass/ceramic slab. The base can also be formed by using rubber base formers. Stone/plaster is mixed and poured in the base former and the cast is placed on the mix. Wait till the base is set and hard enough for trimming to make the artistic portion. Base trimming is started from the posterior end of the lower cast.

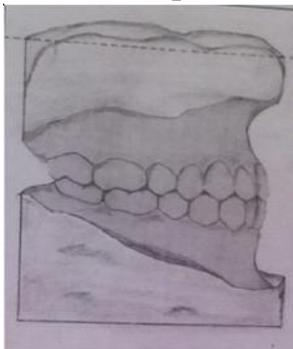
#### Step I



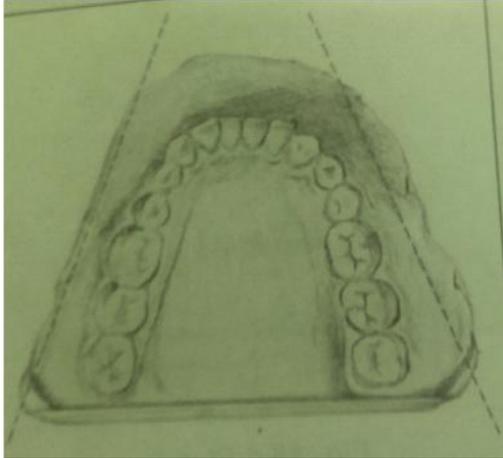
#### Step II



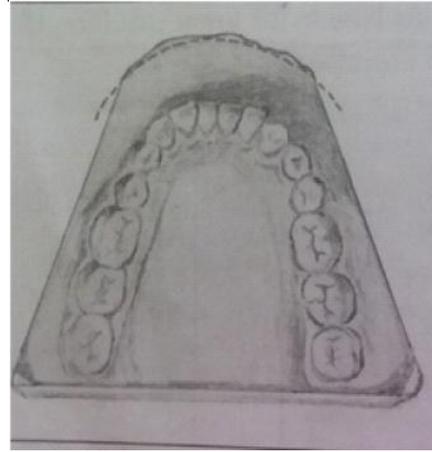
#### Step III



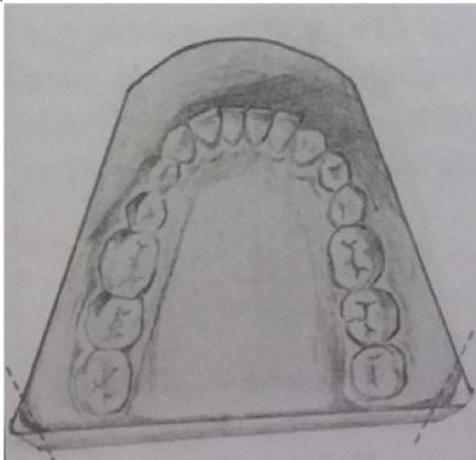
**Step IV**



**Step V**



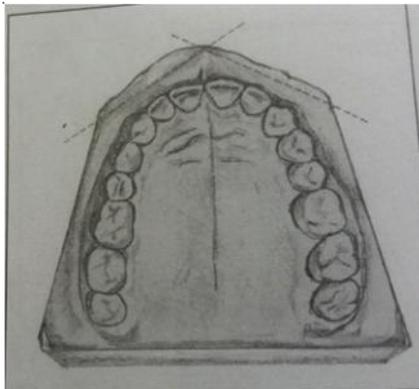
**Step VI**



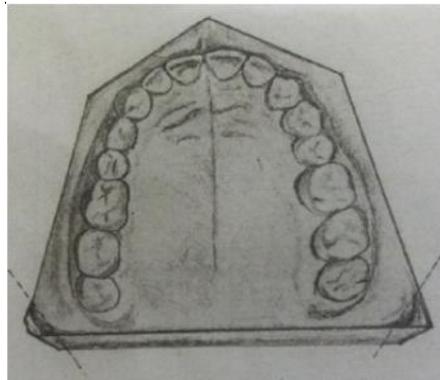
**Step VII**



**Step VIII**



**Step IX**



### Detailing of Practical

1. Preparation of Orthodontic Cast
2. Straightening of wire
3. Making of Square
4. Making of Triangle
5. Making of Semi circle
6. Making of Circle
7. Making of 'U'Loops, 'V'Loops, U-V Loops

### Assessment Activities

Practical evaluation of prepared square, rectangles, v, u loops etc..

Different pliers are given for identification Diagrams showing the molar relation of different classes of malocclusion are given for identification.

Chart depicting different orthodontic appliances.

Appliances are given for identify the anchorage unit

### Sample Questions

1. List down the class I, class II, class III malocclusion
2. The orthodontic force given should be optimum. Comment on
3. Define occlusion
4. Write in detail angles classification of malocclusion.
5. What are the reasons for orthodontic treatment?
6. What are the problems associated with malocclusion
7. What are the local factors of malocclusion?
8. What are the general factors of malocclusion?
9. Write different stages of tooth movement
10. Write different types of tooth movement
11. Write different types of orthodontic forces
12. A patient presents himself to the clinic with the following characteristics
  - D-B cusp of Maxillary first molar occlude with M-B groove of Md. 1st Molar.
  - Proclination of anterior

- a. Identify the Malocclusion given.
  - b. Classify Malocclusion according to angles classification.
13. Name two types of tooth movement that takes place during orthodontic movements.
  14. Angle's classification of Malocclusion is based on.....
    - a) Describe Angle's classification of Malocclusion.
  15. What are the difference between fixed and removable orthodontic appliances?
  16. List down different anchorages used in Orthodontic treatment.

## Unit. 4.2.

### Fixed Orthodontic Appliances

They are orthodontic appliances that are fixed on the teeth of bands or cementing materials, which cannot be removed by patient at will are called fixed appliance. The tooth movement that are possible are tipping, bodily movement, torqueing, up righting, rotation, extrusion and intrusion.

**Learning Outcomes :** The learner

- identifies the different components of fixed orthodontic appliances suggest the ideal orthodontic treatment
- Identifies the advantages and disadvantages of fixed orthodontic appliances

#### UNIT IN DETAIL

##### 4.2.1 Fixed Orthodontic Appliance

Fixed orthodontic appliance that are fixed on the tooth which cannot be removed by patient are called Fixed Orthodontic Appliance. All most all the tooth movement are possible. The component of F.O.A are classified in to active and passive component. Passive component act as a medium in the transmitting of the force exerted by the active component towards the teeth. They are bands, brackets, buccal tubes, lingual attachment, lock pin and ligature wire. Active components can exert orthodontic force and effective tooth movement. They are arch wire, springs, elastics, and separators. The learners must come to know the advantages and disadvantages of Fixed Orthodontic Appliance

##### Passive components

Bands-Bands are components that helps in fixing various attachments on to the

tooth. They are available in various sizes to be used on different teeth. They are made up of soft stainless steel. The attachments like molar tubes and brackets are soldered or welded over these bands.

Brackets- They transmit the force from active components to the teeth. Brackets have one or more slots that accept the arch wire.

Buccal tubes- Buccal tubes are welded on the bands and bands are cemented on molars.

Lock pins-It is made of brass. It is used to hold arch wire in the bracket, which have vertical slots(Beggs bracket)

Ligature wire-It is a soft stainless steel wire used to secure arch wire in the bracket.

Lingual attachments-These components are fixed on the lingual aspect of tooth .Used for attaching elastics

### **Active components**

Arch wire- They bring about tooth movements through the medium of brackets and buccal tubes. It should have low stiffness, high formability, superior elasticity, high resiliency, and biocompatibility. Depending on the cross section, arch wires are round, square, rectangle, and multistranded

Elastics-They are routinely used as active components of fixed orthodontic appliances. The elastic products used in orthodontics include simple elastics, elastic chains, elastic thread and elastic modules. The main purposes of using elastics are closure of space, to correct open bite, treatment of cross bite, and to correct inter-arch relationship.

Springs-springs can be used to bring about various tooth movements. The springs used in fixed orthodontic treatment are up righting spring, torqueing spring, open coil spring, closed coil spring etc.

Separators- It is used to break tight interdental contacts. Various types of separators are brass wire separators, spring separators, dumbbell spring, kesslings

### **Spring separators.**

Advantages of fixed appliances.

1. It can bring about almost all the tooth movements.
2. Severe malocclusions can be treated effectively.
3. Multiple tooth movements are possible.

4. Patient cooperation is not a major concern.
5. There is a better control over tooth movements.

Disadvantages of fixed appliances

- 1) It is difficult to maintain good oral hygiene
- 2) It is more expensive than removable appliances
- 3) Fixed appliances are more conspicuous
- 4) Fixed appliances take a lot of chair side time of orthodontist



*Ceramic Brackets*

### **Detailing of practical**

- 1) Spotters identification

### **Assessment activities**

1. Components of Fixed Orthodontic Appliances are kept for identification
2. Conduct seminar/debate on the topic comparison of Fixed orthodontic treatment and removable orthodontic treatment

### **Sample Questions**

1. List down the different components of Fixed Orthodontic Appliances in the below given column:

<b>Active components</b>	<b>Passive Components</b>
1.	5.
2.	6.
3.	7.
4.	8.

2. Compare Fixed Orthodontic Treatment and Removable Orthodontic Treatment

3. What are the active components of fixed orthodontic appliances?
4. What are the passive components of fixed orthodontic appliances?
5. What are the advantages and disadvantages of fixed orthodontic appliances?
6. Fixed orthodontic appliances are those which fixed on to the teeth by the dentist and cannot be removed by patient.
7. Name the components of fixed orthodontic appliances
8. Pick the odd one out  
Separators, Arch wire, buccal tube, Lock pins, Clasps.
9. You were asked to make an expansion appliance using expansion screw in your lab.
  - a) Name the parts of the expansion appliance.
  - b) Write the step by step procedure you will follow while constructing the appliance.

### Unit 4.3

#### Removable Orthodontic Appliance

They are mechanical orthodontic appliances that can be inserted and removed from the oral cavity by the patient. The main components are retentive components, active component and baseplate

**Learning Outcomes :** The learner

- Identifies the components of removable orthodontic appliances
- Suggests the ideal components for the fabrication of removable orthodontic appliances.
- Identifies the different types of orthodontic appliances
- Suggests the ideal components for the fabrication of removable orthodontic appliances
- Identifies the different types of clasps, fabricate clasps, suggest ideal clasp
- Identifies the different types of bows, fabricate bows, suggest ideal bows
- Identifies the different types of springs, fabricate springs, suggest ideal springs
- Identifies expansion screws, coffin spring
- Fabricates coffin spring

- Identifies the different removable orthodontic appliances and its indication

## UNIT IN DETAIL

### 4.3.1 Removable Orthodontic Appliance

Removable appliances are mechanical orthodontic appliances that can be inserted and removed from the oral cavity by the patient.

Components of removable appliances

Removable orthodontic appliances are made up of three basic components.

1. Retentive components.
2. Active components.
3. Base plate.

#### **Hawley's Appliance for retraction**



*Hawley's Appliance*

Active Component- Labial Bow

Retentive Component -Adams Clasp and Base Plate are seen in this diagram

Retentive components

These are those parts of the removable appliances that help in retaining the appliances in the desired position and resist forces that try and dislodge/displace them. They also aid in providing adequate anchorage which is necessary in bringing about the intended tooth movement.

#### **Active components**

Active components are those parts of the removable appliance that exert force on the teeth that are to be moved. Active components can be in the forms of bows, springs, screws and elastic. Active components of removable appliances.

1. Bows
2. Springs

3. Screws
4. Elastic - (Elastics are active component usually used in fixed orthodontic appliance. Sometimes they are used in removable appliance also.)

### **Base plate**

Base plate is that part of the removable appliance which incorporate all the retentive and active components. Along with the retentive components it helps in retention of the appliance. It is made in self-cure acrylic resin or heat - cure acrylic resin.

Advantages of removable orthodontic appliance.

- 1) Oral hygiene can be maintained easily.
- 2) Removable appliance require less chair side time.
- 3) It is less expensive.
- 4) The appliance can be removed for any social gathering if desired by the patient
- 5) Can correct malocclusion that require tipping movement tooth.

Disadvantages of removable orthodontic appliances.

1. The major disadvantages of the removable orthodontic appliances is the limitation in producing varied types of tooth movements.
2. They are capable of only tipping movements.
3. Removable appliances requires maximum patient's co-operation as it can be removed and replaced at any time.
4. Removable appliances are more likely to get damaged or misplaced than fixed appliances.
5. Physically and mentally challenged patients find it difficult to manage removable appliances.

### **4.3.2 Retentive Component ( Clasp)**

Removable orthodontic appliances are made up of three basic components.

1. Retentive components.
2. Active components.
3. Base plate.

The clasps used as retentive components for removable orthodontic appliances are as follows:

1. Circumferential clasps or C - Clasps
2. Adams clasps
3. Jackson's clasps
4. South end clasps
5. Triangular clasps
6. Ball end clasps
7. Schwarz clasps
8. Crozat clasps
9. Duyzing clasps
10. Delta Clasps
11. Eyelet clasps

Clasps are the retentive component of a Removable Orthodontic Appliance . There are so many types of clasps such Adams clasp, Crozat clasp, triangular clasp etc...

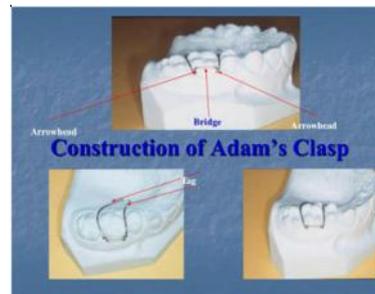
Adams clasp and C clasp are commonly used. Adams clasps are superior to all due to its advantages.

Advantages of Adams clasp

It can be made for all teeth. It can be easily formed. It can be made on deciduous teeth and permanent teeth. It can be made on partially erupted and rotated teeth. It has good retention.

Modification of Adams Clasp

- Adams clasp with helix
- Adams clasp with single arrow head.
- Adams clasp with soldered hook.
- Adams clasp with buccal tube
- Adams clasp with distal extension.



The procedure of Adams clasp fabrication should be thorough with the learners.

### Points to be noted

1. The arrow heads should be positioned at buccal proximal undercut (mesial and distal)

2. The bridge is placed in the middle third of buccal surface of the tooth.
3. When viewed from the side, the bridge should be at 45° to the long axis of tooth.
4. The bridge should be extended from one clasp tip to another
5. The retentive arm should not interfere with occlusion.
6. The tag should be placed for retention to the acrylic.

### 4.3.3. Bows

Bows are active components of Removable Orthodontic Appliance. They are mainly used for retraction of teeth. Different bows are split labial bow, short labial bow, long labial bow, reverse labial bow, beggs labial bow etc.



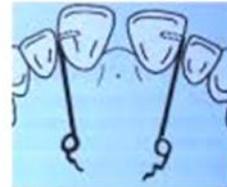
Parts of labial bow includes horizontal arm or horizontal position, U-loops, tag arm. The fabrication procedure of labial bows are important (short and long) Its uses are minor anterior space closure, minor over jet retraction, and for construction of retention appliances.

### 4.3.4. Springs

Springs are active components of Removable Orthodontic Appliance. The flexibility and springiness is utilized in effecting tooth movement. This depends on the dimension of the wire. Thinner wire is more flexible than thicker wire

#### Removable orthodontic appliances

- Active components
- \* Springs
  - i) Finger spring:-
    - most important removable orthodontic appliances.
    - used for mesiodistal movement of the teeth.



#### Classification of Springs

- A Depending upon the presence of support springs are of two types :
1. Self-supporting (These are rigid springs made of thicker gauge wire)
  2. Guided or supporting (These are fragile springs made of thinner gauge wire. They lack stability. Metal tubes are provided for stability)
- B Depending on the presence or absence of helix or loop
1. Simple springs (springs which do not have any helix or loop eg. Coffin spring)

## 2. Compound spring (springs which have a helix or loop eg.cantilever spring)

Types of springs, its indication and activation fabrication.

The important springs that have to be learned are finger spring, Z-spring, self-supported canine retractor, coffin spring etc. The fabrication procedures and indications are very important.

### **Guided Spring**

Guided Springs are usually made up of thinner wire. Hence they get destroyed.

### **Selfsupported Spring**

Self-supported springs are made of thicker wire. They can support by themselves.

### **Finger Spring**

The finger spring is also called single cantilever spring. One end is fixed in acrylic and the other end is free. It is constructed using 0.5 or 0.6mm stainless steel wire.

### **Indication:**

It is used for the mesio distal movement of teeth.

### **Parts:**

The finger spring consist of an active arm of 12-15mm length a helix of 3mm internal diameter and retentive arm of 4.5mm length. It is activated by closing the coil.

### **Z-Spring**

Z-Spring is otherwise called double cantilever.

### **Indication:**

Z-Spring is used for the labial movement of incisor.

### **Construction:**

It is constructed using 0.5mm round stainless steel wire. It consist of two coils or helix. It has retentive arm of 10 to 12mm length. It is activated in opening the coil.

### **Parts:**

Z-Spring is made of 0.5mm stainless steel wire. It consist of two coils of very small internal diameter. The spring should be perpendicular to the palatal surface of the tooth. It has retentive arm of 10-12mm length. It is activated by opening both the helix.

### **Self supported canine Retractors**

These springs that are used to move canines in a distal direction.

Eg:-

- 1) 'U' loop canine retractor
- 2) Helical canine retractor
- 3) Buccal self-supported canine retractors.
- 4) Palatal canine retractor.

### **Buccal Self Supported Canine Retractor**

It is made of 0.7mm wire. It consist of a helix of 3mm diameter. All active arm and a retentive arm. It is called self-supported spring because it is made of thicker diameter wire which can resist distortion. It is activated by closing the helix.

### **Coffin Spring**

This is introduced by Dr. Walter Coffin. This is a removable type of arch expansion spring. It is used for slow dento alveolar arch expansion. (The coffin spring is made of 1.2mm hard round stainless steel wire. It consist of a 'U' or omega shaped wire placed in midpalatine region with retentive arm is cooperated in the base plate. The retention is joined by Adam's clasp.)

### **4.3.5 Expansion Components-**

The appliances used for maxillary arch expansion can be classified as

- 1) Removable appliances
- 2) Fixed appliances
  - a) Tooth borne
  - b) Tooth and tissue borne

Here we have to give importance to removable appliances. The expansion screw and coffin spring are used as expansion components

When we make the appliance with coffin spring the free ends of the omega shaped spring is embedded in the acrylic covering the slopes of the palate. The spring is activated by flattening the U part of coffin spring which pushes the acrylic plates and causes slow dento alveolar expansion

Screws are active component that can be incorporated in a removable appliance. Removable appliance with screws generally consist of a split acrylic plate and Adam's

clasps on the molar teeth. The screw is placed connecting the split acrylic plate. This appliance can bring about three types of movement.

1. Expansion of arch.
2. Movement of one or group of teeth in buccal or a labial direction.
3. Movement in one or more teeth in distal or mesial direction.

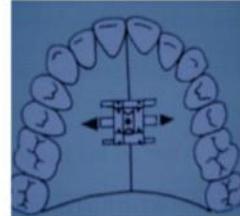
Eg:-

- 1) Symmetrical and bilateral expansion.
- 2) Unilateral expansion screw
- 3) dimensional screw.

• Screw:-

It's active component of the removal appliance. It is activated by the patient by using a key. Mainly it can bring about three types of movements-

- Expansion of arch.
- Movement of teeth or group of teeth in buccal or labial direction.
- Movement of teeth or group of teeth in mesial or distal direction.



#### 4.3.6. Fabrication of appliance

Generally fabrication of appliance include fabrication of wire components and base plate. An accurate working cast is necessary. The working cast should be soaked in water and the undercuts are blocked with wax . In the working cast the wire components are made first. Then it is taken and kept safely. Apply separating media on the cast evenly. Allow it to dry. Assemble the wire components in the exact position. And then apply self-cure acrylic resin on the cast, first on the tag arm of wire components and then on the other areas. Apply the resin mix evenly. Wait for the material to set. After it sets the appliance is taken as one unit, then trimmed and polished.

Fabrication of removable orthodontic appliance in different conditions

##### 1) Narrow maxillary arch

Suggested appliance is a removable orthodontic expansion appliance. It consists of a split acrylic plate with a mid-line screw or coffin spring. Screws are more frequently used now.

The appliance is retained using clasps on the posterior teeth. The screws are activated using a key. When coffin spring is used the free ends of the omega shaped wire are embedded in the acrylic covering the slopes of the palate. The spring is activated by flattening the U part of coffin spring which push the acrylic plates and causes slow dento alveolar expansion.

If screws are used instead of coffin spring a screw is placed in the middle of split acrylic plate (mid palatal area). A typical expansion screw consist of an oblong body divided into two halves. Each half has a threaded inner side that receives one end of a double endedscrew. The screw has a central bossing with four holes. These holes receive a key that is used to turn the screw, thus causing activation by pushing the split acrylic plate and results in expansion of arch. Fabrication of appliance include fabrication of wire components and base plate. An accurate working cast is necessary. The working cast should be soaked in water and the under cuts are blocked with wax. In the working cast the wire components are made first. Then it is taken and kept safely. Apply separating media on the cast evenly. Allow it to dry. Assemble the wire components in the exact position. And then apply self-cure acrylic resin on the cast, first on the tag arm of wire components and then on the other areas. Apply the resin mix evenly. Wait for the material to set. After it sets the appliances is taken as one unit, then trimmed and polished. Here the acrylic plate is split in the midline

#### **Proclined upper anterior teeth-**

The suggested appliance is removable orthodontic appliance with Adams clasp as retentive components, labial bow as active component and base plate. The anterior part of the base plate is trimmed to provide space for the retraction of anterior teeth during activation. Generally fabrication of appliance include fabrication of wire components and base plate. An accurate working cast is necessary. The working cast should be soaked in water and the under cuts are blocked with wax. In the working cast the wire components are made first. Then it is taken and kept safely. Apply separating media on the cast evenly. Allow it to dry. Assemble the wire components in the exact position. And then apply self-cure acrylic resin on the cast, first on the tag arm of wire components and then on the other areas. Apply the resin mix evenly. Wait for the material to set. After it sets the appliances is taken as one unit, then trimmed and polished.

#### **Buccally placed canine**

Suggested appliance consist of canine retractor as acting component Adams clasp as retentive components an base plate. Generally fabrication of appliance include fabrication of wire components and base plate. An accurate working cast is necessary. The working cast should be soaked in water and the undercuts are blocked in wax. In the working cast the wire components are made first. Then it is taken and kept safely. Apply separating media on the cast evenly. Allow it to dry. Assemble the wire components in the exact position. And then apply self-cure acrylic resin on the

cast, first on the tag arm of wire components and then on the other areas. Apply the resin mix evenly. Wait for the material to set. After it sets the appliances is taken as one unit, then trimmed and polished.

#### **Palatally tilted upper central incisor-**

Suggested appliance consist of Z spring as acting component adams clasp as retentive component an base plate( in addition to that a labial bow can also be given to resist any undesired movements of anterior teeth). Generally fabrication of appliance include fabrication of wire components and base plate. An accurate working cast is necessary. . The working cast should be soaked in water and the undercuts are blocked with wax. In the working cast the wire components are made first. Then it is taken and kept safely. Apply separating media on the cast evenly. Allow it to dry. Assemble the wire components in the exact position. And then apply self-cure acrylic resin on the cast, first on the tag arm of wire components and then on the other areas. Apply the resin mix evenly. Wait for the material to set. After it sets the appliances is taken as one unit, then trimmed and polished.

#### **Midline diastema-**

Suggested appliance consist of Two Finger spring as acting component Adams clasp as retentive component an base plate( in addition to that a labial bow can also be given to resist any undesired movements of anterior teeth). Generally fabrication of appliance include fabrication of wire components and base plate. An accurate working cast is necessary. The working cast should be soaked in water and the under cuts are blocked with wax. In the working cast the wire components are made first. Then it is taken and kept safely. Apply separating media on the cast evenly. Allow it to dry. Assemble the wire components in the exact position. And then apply self-cure acrylic resin on the cast, first on the tag arm of wire components and then on the other areas. Apply the resin mix evenly. Wait for the material to set. After it sets the appliances is taken as one unit, then trimmed and polished.

#### **Detailing of practicals**

1. Identification of active and retentive components in the given removable orthodontic appliance.
2. Fabrication of
  - Adams clasp
  - C clasp

- Z Spring
  - Finger spring
  - Coffin Spring
  - Labial bow (Long and short)
3. Fabrication of appliances in cases like
    - Narrow maxillary arch
    - Midline diastema
    - Palatally tilted central incisors
    - Proclined upper anteriors
    - Labially placed canine

**Assessment Activities**

1. Seminar presentation on the topic
  - Components of Removable Orthodontic Appliance,
  - Advantages and Disadvantages of Removable Orthodontic Appliance
  - Fabrication of different removable orthodontic appliances.
2. Puzzles
3. Quiz.
4. Charts Showing Diagrammatic representation of different appliances and its indication.

**Sample Questions**

1. Match the following

A	B
Palatally tilted central incisor	Finger Spring
Midline Diastema	Z spring
Narrow maxillary arch	Canine retractor, Coffin Spring

2. The commonly used retentive components is .....
3. Find the word pair relation

Adams clasp, coffin Spring, Proclined. Anterior teeth,  
Arch Expansion, Retentive Components

4. Write the components of removable orthodontic appliances.
5. What are the advantages and disadvantages of Removable Orthodontic Appliance?
6. Write different types of clasps.
7. What are the modifications of Adams clasp?
8. Write in detail the steps in preparing an Adams clasp.
9. Write different types of labial bows
10. Classify springs.
11. Different types of spring and their uses.
12. The statements given below have some factual errors. Identify and correct them.
  - 'Z' springs are indicated for the correction of midline diastema.
  - Clasp are active components, which can bring about active tooth movements.
13. Detect the similarity and difference between 'Z' spring and canine retractors.
14. You are asked to construct a 'U'-loop canine retractor for an appliance for the retraction of canines. Write the procedure you will undergo for the same with diagrams. Also mention the materials you will use for the construction.
15. How do you activate the following
  - a) Long labial bow
  - b) Z spring
  - c) Coffin spring
  - d) Canine spring.
16. Write the role of the following components in dentistry.
  - a) Adam's clasp
  - b) Separators
  - c) Canine retractor.

17. One type of spring is shown:
  - a) Identify the spring
  - b) Name its use
  - c) Name 3 more types of spring and its use.
18. Pick the one odd out
  - a) Spring
  - b) Jackson's clasp
  - c) Canine retractor
  - d) Short labial bow
19. In orthodontic appliances ..... wire is used to make clasps and springs.
20. An example of a self-supporting spring.
21. .... spring is used for the mesiodistal movements of tooth.
22. What are the uses of labial bow?
23. Give an example each for guided spring and self-supporting spring.
24. What are the parts of Adam's Clasp?
25. Classification of springs with examples.
26. Describe the construction of a removable orthodontic appliance used for slow dentoalveolar expansion.
27. Describe finger spring with the help of a diagram.
28. Write a note on Hawley's retraction plate.
29. Mention the parts of removable orthodontic appliances and discuss.
30. Describe Adam's clasp with the help of diagram.
31. Split labial bows are used for the correction of.....
32. You were asked to make an expansion appliance using expansion screw in your lab.
33. A patient presents himself with mild crowding of teeth. The doctor decides to give an expansion. Appliance and asks you to prepare one. Write the procedure you will undergo to prepare the appliance with the coffin spring.

## 4.4.

### Myofunctional Appliances

Myofunctional appliances /functional appliances are passive appliances which harness the natural forces of the orofacial musculature that are transmitted to the teeth and alveolar bone through the medium of the appliance. They do not cause tooth movement by directly applying force. They guide the growth of jaws there by intercepting and treating malocclusions .Functional appliances work an two principles. Force application and force elimination.

**Learning Outcomes :** The learnes

- Identifies advantages, disadvantages,
- Identifies different myofunctional appliances and classify myofunctional appliances.
- Identifies the different functional appliances, assist in the fabrication of the appliances. able to fabricate oral screen

#### UNIT IN DETAIL

##### 4.4.1. Introductions to Myofunctional Appliances

Myofunctional /functional Appliances are loose fitting or passive appliances, which harness natural forces of the oro-facial musculature that are transmitted to the teeth and alveolar bone through the medium of the appliance.

Functional Appliances work on two Principle

1. Force application
2. Force elimination

#### Classification of myofunctional Appliances

1. Tooth -borne passive appliances
2. Tooth -borne active appliances
3. Tissue - bone appliances

Myofunctional Appliances can also be classified as

1. Group -I appliances
2. Group - II appliances
3. Group -III appliances

**Advantages**

1. They treat malocclusion by aiding growth neither than moving teeth
2. They are well - tolerated, can worn at night
3. They do not produce any enamel decalcification
4. They are easy to maintain oral hygiene

**Disadvantages**

Requires good patient co-operation

Cannot be used in adult patient

Requires mechanical appliance therapy before or after treatment with myofunctional appliance

Do not cause individual tooth movement

**Examples of Myofunctional Appliances**

- Bite planes
- Oral Screen
- Activator
- Lip Bumper
- Frankel's appliance
- Bionator
- Herbst appliance

**4.4.2. Bite planes**

Bite planes are extensions of base plate of removable orthodontic appliance it is classified in to anterior bite plane and posterior bite plane

Anterior bite plane - To correct Anterior deep bite

Posterior bite plane - Anterior cross bite

**Oral screen** ( vestibular screen )- Introduced by New well

**Indicated in** - Thumb sucking, mouth breathing, tongue thrusting ,lip biting ,mild proclination of anterior teeth

**Activator** - Indicated for class II cases, Retrognathic mandible

**Lip bumper**-used correct lip biting

**Frankel's Appliance** ( Developed by professor Rolf Frankel's) - regulate and correct abnormal perioral muscle functions.

**Bionator** - Similar to activator

### Oral Screen

#### Construction

Upper and lower cast with exact depth of the vestibule are made. They are sealed in occlusion

Wax spacer is placed in the vestibule area extending from the distal margin of the last irrupted molar on one side to the other. The spacer should touch the depth of this sulcus. If the oral screen is suggested to retrude the anterior teeth a window can be made in the anterior

region to exposed to the teeth. Self cure resin mix is directly applied over the spacer wax which act as the a separating media. After the resin polymerises it is removed from the cast. Wax is removed. Then the appliance is trimmed and polished. It can also be made with heat cure acrylic resin.



*Oral Screen*

#### Detailing of practicals

- 1) Identification of different myofunctional appliances
- 2) Fabrication of oral screen

#### Assessment Activities

Charts showing diagrams of functional appliance and its uses, puzzle, quiz, collection of photos of patient use in functional appliance, showing before and after treatment results, seminar presentation

#### Sample Questions

1. Oral screen used in -----
2. Suggest an appliance to correct anterior cross bite is.....
3. List down any three myofunctional appliances with its uses
4. Define myofunctional appliances
5. Classify myofunctional appliances
6. What the advantages of myofunctional appliances..... Is an example of Myofunctional appliances.

7. What is Myofunctional appliances?
8. Briefly describe the steps involved in the construction of a Myofunctional appliances.
9. Your group is asked to prepare a seminar on "Comparison between mechanical and myofunctional appliances". Write the seminar you prepared for your group.
10. Match the following.

A	B
Lip Bumber	Retention
Hawley's Appliances	Mouth breathing
Oral Screen	Deep bite + crossbite
Activator	Lip biting
Bite Plane	Class II cases

## Unit 4. 5

### Space Maintainers

Deciduous teeth are meant to exfoliate and space created by loss is taken up by the replacing permanent tooth. But the early loss of the deciduous tooth can cause some undirected consequences such as derangement of occlusion, T.M.J pain, reduction of arch length, mesial and distal migration of teeth etc. To counter these consequences space maintainers are suggested.

**Learning Outcome :** The learner

- Identifies the different space maintainers.
- Chooses the types of appliances.
- Identifies the different fixed space maintainers.
- Identifies and fabricate removable space maintainers.
- Identifies the different space regainers.

### UNIT IN DETAIL

#### 4.5.1 Space maintainers

The early loss of deciduous teeth leads to many consequences eg. Mesial migration

of distal tooth, distal migration of mesial tooth, derangement of occlusion . To counter the consequences space maintainers are used. It is classified into fixed and removable space maintainers.

#### 4.5.2. Fixed Space maintainers

Examples of fixed type are Band and loop space maintainers

Crown and loopspace maintainers

Distal shoe space maintainer etc.

#### 4.5.3. Removable Space maintainers

Removable type is nothing but a removable partial denture sometimes without teeth

It is used to regain space lost by adjacent teeth eg. Band and loop with coil

#### **Detailing of practicals**

Identification of appliances

Can assist in dental labs in the fabrication

Transpalatal arch is indicated when one side of the arch is intact and several primary teeth on the other side are missing.

#### **Assessment activities**

Seminar presentation,quiz,

#### **Sample Questions**

1. Write different types of space maintainers.
2. What are the consequences of early loss of teeth.
3. Classify space maintainers

## Unit. 4.6

### **Habit Breaking Appliances**

Oral habits can cause changes in the oro-facial structure. So it is very much concerned to a dental surgeon .The different oral habits that can cause many undesired intraoral and extra oral manifestation are thumb/digital sucking,tongue thrusting,lip biting,bruxism, mouth breathing,nail biting etc.

**Learning Outcome :** The learner

- Identifies the habit breaking appliances

- Fabricates different habit breaking appliances.

## UNIT IN DETAIL

### 4.6.1. Introduction to Habit breaking appliances

Habits-It is a mode of behaviour in which repetitive and successive actions occur.The orofacial structural changes caused by the habits are the major concerns for the dentist.

Habits can be classified in many ways

- I Intentional habits-Unintentional habits
- II Pressure habits-Non pressure habits
- III Compulsive habits-Non compulsive habits

### 4.6.2. Habit breaking appliances

Habit breaking appliance have to be given in the following cases

- Digital/thumb sucking
- Tongue thrusting
- bruxism
- mouth breathing
- Nail biting

#### Digital/thumb sucking

The appliances suggested is Hawley's appliances with cribs/spikes. This can be given as fixed or removable appliances. When fixed appliance is given instead of clasps, bands are provided which are cemented in the molars.

#### Tongue thrusting

Hawley's appliances with palatal cribs or bead is given. Its fabrication is done.

#### Hawley's Appliance With Palatal Cribs

Hawley's appliance with palatal cribs or spikes is given in case of tongue thrusting or thumb or digital sucking. The appliance consist of cribs or spikes kept in anterior part of the base plate from canine to canine, labial bow and clasps on molars and baseplate



**Fabrication:** Generally fabrication of appliance include fabrication of wire components and base plate. An accurate working cast is necessary. The cast is soaked in water and the undercuts are blocked with wax. In the working cast the wire components are made first. Then it is taken and kept safely. Apply separating media on the cast evenly. Allow it to dry. Assemble the wire components in the exact position. And then apply self-cure acrylic resin on the cast, first on the tag arm of wire components and then on the other areas. Apply the resin mix evenly. Wait for the material to set. After it sets the appliances is taken as one unit, then trimmed and polished.

### **Lip biting**

Lip bumper is used

**Bruxism** (-Night grinding-)

Soft splints are given.

### **Mouth Breathing**

Oral screen is suggested- fabrication of oral screen is done.

Detailing of practicals

- Identification of different habit breaking appliances .
- Fabrication of oral screen.

Fabrication of tongue guard appliance

### **Assessment activities**

Open book assessment

Fabrication of oral screen

Fabrication of Hawley's appliance with palatal cribs

Demonstration of procedure

Spotters

Case study

### **Sample questions**

1. Suggest Habit breaking appliances for the following conditions
  - a. Bruxism
  - b. Tongue thrusting
  - c. Mouth breathing

2. Write a short note about the fabrication of Hawley's appliance with palatal cribs
3. Write in about detail fabrication of appliance for thumb sucking
4. The doctor prescribes a mouth breathing appliance to patient.
  - a) Name the appliance
  - b) Explain the construction of the appliance.
5. Pick the odd one out  
Deep bite, Bruxism, Mouth breathing, Lip biting.

## **Unit. 4.7**

### **Retainers**

Retention is defined as maintaining newly moved teeth in position, long enough to aid in stabilizing their correction.

Retainers are needed because teeth after orthodontic treatment have the tendency to revert back to the previous oral positions. To prevent this retainers are used.

**Learning Outcome :** The learner

- Identifies different types of retainers and assist the dental surgeon.
- Identifies different retainers
- Different removable retainers.
- Assists in dental lab.
- Identifies different types of fixed retainers

### **UNIT IN DETAIL**

#### **4.7.1. Retention**

Retention is defined by Moyer's as maintaining newly moved teeth in position, long enough to aid in stabilizing their correction.

Relapse is defined as the loss of any correction achieved by orthodontic treatment.

Relapse after orthodontic treatment can be prevented by using retention appliances. It helps in maintaining and stabilizing the position of teeth till the supporting structures reorganised completely

Types-Removable retainers and fixed retainers.

## 4.7.2 Removable Retainers

Types of removable retainers

1. Hawley's appliance
2. Begg retainer
3. Kesling Tooth positioner
4. Spring aligner

Hawley's retainer is very popular. Its fabrication is explained and done.

Hawley's appliance consists of a labial bow, clasp and base plate. It has many advantages

1. The appliance has a simple design.
2. It is easy to construct
3. It is tolerated well by the patient
4. It can be modified easily



The construction of Hawley's appliance is easy. An accurate impression is made and cast is made out of it. A labial bow and pair of Adams clasp on molars are made. Acrylization is done then the appliance is trimmed and polished

## 4.7.3 Fixed retainers

Types

1. Band and spur retainer
2. Banded canine to canine retainer
3. Bonded lingual retainer (This is a commonly used fixed retainer)



**Detailing of Practicals**

Fabrication of Hawley's retention appliances

Spotters

Identification of different types of retention appliances

**Assessment activities**

Open book assessment

Fabrication of Hawley's retention appliance

Seminar presentation

Collection of data from clinics

Case study

### **Sample Question**

1. Identify the role of Hawley's appliance as a removable retainer
2. What are retainers.
3. Write different types of retainers with examples.
4. Advantages of Hawley's retention appliance

## **Unit. 4.8**

### **Dental Assistance Part-2**

This unit deals with perhaps the most sensitive area in dental practice - The front office/Reception. The learner is taken through the administrative aspects and patient management in the reception. The learners are also exposed to the chair side procedures so that they will be able to assist in

1. Patient preparation before dental procedures
2. Dental surgical as well as non-surgical procedures.
3. Taking dental X-rays etc.

**Learning Outcome :** The learner

- Assists a dental surgeon in taking dental X-rays such as Periapical, bite wing, occlusal etc.
- Assists a dental surgeon in taking protective measures during X-ray taking.
- Manages front office of dental clinic.
- Assists a dental surgeon during chair-side treatment procedure

### **UNIT IN DETAIL**

#### **4.8.1. X-ray**

X-ray - Dental radiographs have become an inseparable modality in diagnosis of dental ailments and with time there are marked improvements in dental X-ray techniques. Here the learner has to assist a dental surgeon in taking X-rays. It is important that the operator and the assistant has to wear lead aprons for self protection. The patient will be given lead collars. The operator should stand as far away from the source as possible. Minimum six feet distance is recommended.

**Follow the following rules.**

1. Distance rule of six feet and an angle of 135 is recommended as a safer zone.
2. The operator should never hold the film in patients mouth.
3. The operator should never hold the X-ray tube during exposure.
4. Personal monitoring device should be used and checked every week.
5. Protective guards should be used by both the operator and the patients.
6. Should always get informed about never materials and various protection devices.

**Front office management.**

The main role is to attend the patients on phone and in person. Co-ordinate and organise appointments and administration to facilitate the efficient running of the dental office or dental clinic.

**Main job Tasks and responsibilities.**

1. Greet the patients.
2. Register new patients according to established office protocols.
3. Verify and update patient's information.
4. Inform the patients office procedures and policy.
5. Assist patients to complete all necessary forms and documentation.
6. Move patients through appointments as scheduled.
7. Enter all the relevant patient information to data system.
8. Answer and manage incoming calls.
9. Despatch lab work appropriately.
10. Check the daily appointment schedule of arrange patient chart for next day appointments.
11. Maintain a Professional reception area.
12. Arrange payment schedule with patients.
13. Safeguard patient privacy and confidentiality.
14. Update patient education materials.
15. Collect and receipt payments from patients at the time of treatment.

### **Chair-side management**

In the first module we have seen how a dental assistance help the dental surgeon in various lab procedures which can support clinical procedures. In this module we have to see how a dental assistant help a dental surgeon in chair-side procedures.

Prepare treatment room for patient by prescribed procedures and protocols. Prepares patient for dental treatment by welcoming comforting, seating, draping patient. Provides information to patients and employees by answering questions and requests. He/She has to pass requested instruments to the dentist during dental procedures. Has to assist in sterilization and preparation of instruments. They should educate the patients about importance of dental health, how to maintain oral hygiene during orthodontic treatment, and also to main the prothodontic appliances hygienically. Can remind the patients about the intake of prescribed medicines and post operation care instructions given by the dentist.

### **Detailing of Practicals.**

Role Play.

Identification of instruments used in dental clinic.

Identification of different dental x-rays.

### **Assessment activities**

Clinic visit

Role play

Group discussion

Debate, Seminar.

### **Sample questions**

1. List down the different steps you have to be taken care while assisting a dental surgeon in taking an IOPAR.
2. Identify the main responsibilities that a dental assistant has to take while working in the front office of dental clinic

## Unit. 4.9

### Soldering And Welding

It is often necessary to join two metal ends in making two prosthesis or orthodonti . Broken clasps are common feature with cast partial denture that are over worked or improperly handled. The wire components of orthodontic appliances are also get broken off in many cases. This unit deals with mainly the methods of joining metals and they are divided into three categories that is soldering ,brazing, welding and spot welding.

**Learning outcomes :** The learner

- Differentiates soldering,welding brazing.
- Identifies need of flux and antflux.
- Identifies the need of application of flux and antflux.
- Assists in freehand and investment soldering.
- Selects ideal solder for soldering procedure.
- Identifies the technique of welding and spot welding.
- Assists in fabrication of molar bands for patient cases

#### UNIT IN DETAIL

##### 4.9.1 Definition of soldering

It is the process of joining of metals by the use of a filler metal that has lower fusion temperature than that of the metals being joined .

If the fusion temperature of the filler metal exceeds 450<sup>0</sup> C, then the procedure is termed brazing.

Soldering make use of filler metals having fusion temperature less than450 degree Celsius.

Parent metal-The metals that are being joined

Solder-The filler metal that is used to join the metal parts

Types of dental solders

Gold,silver,copper,zinc,tin,nickel etc.,

#### **Requirements of an ideal solder**

- 1) The solder should have tarnish and corrosion resistance.

- 2) The fusion temperature of the dental solder should be less than that of the parts being joined.
- 3) It should be free flowing
- 4) The strength of the solder should be similar to that of the metals being joined.
- 5) The colour of the solder should match with the parent metals

### **Uses of soldering**

To unite the parts of the bridge.

To establish contact points for inlays and crowns.

To join parts of orthodontic appliances

Welding-Definition of welding

Welding involves the joining of two or more metal pieces directing under pressure without the introduction of a filler metal.

Difference between soldering and welding

### **4.9.2 Flux, Anti-flux**

#### **Flux**

Flux is a material that removes the oxide layer from the surface of parent metal. They are solvents of metallic oxide that keep the parts to be soldered free from oxidation.

#### **Functions of flux**

1. Clean the parent metal surface of any oxides.
2. Prevent the oxidation of parent metal. It allows free flow of solders.

#### **Forms of fluxes**

1. Liquid flux
2. Paste form
3. Powder flux

Liquid flux - solution of borax and boric acid.

Paste form - mixture of borax, alcohol and petroleum jelly.

Powder form - used during casting procedure. Borax glass, Boric acid and Silica.

#### **Anti-flux**

Anti-flux is a material used to confine the flow of molten solder over the metals to be joined.

Eg: of Anti-flux - lead pencil marking, graphite lines and iron rouge.

### 4.9.3 : Principles of soldering

Steps/ Principles of soldering

- 1) Clean the surfaces to be joined .
- 2) Assembling the parts to be joined.
- 3) Selecting the right solder and flux.
- 4) Selection of a proper joint.
- 5) Application of flux.
- 6) Heating and introduction of solder.
- 7) Quenching.
- 8) Use of reducing flame.
- 9) Minimum solder should be used.
- 10) Limited flux should.

Soldering techniques-Free hand soldering and Investment soldering

Investment soldering is carried out when the area of contact between the metallic parts being joined is large and whenever the precision is needed in joining the metals. The procedure involves the embedding of the metal parts in an investment leaving a gap of about 0.13mm between the metals for soldering.

Free hand soldering is usually used in orthodontics. The process involves soldering two metal parts together after adequate stabilization ,without the use of investment ,to precisely hold the parts together.

### 4.9.4 Welding

**Uses**

- a) Joining of metal strips during banding.
- b) Fixing attachments such as brackets and molar tubes on to bands.

**Spot welding**

1. Principles of spot welding

Heat and pressure are the two basic principles involved.



**Spot Welder**

2. Identification of spot welder
3. Procedure of spot welding

Electric current is made to pass through a step down transformer to obtain a low voltage and high amperage current that is conducted through two copper electrodes. The resistance offered by stainless steel to current of high amperage generates very high temperature at the electrodes. The metals to be joined are placed between the electrodes and the switch is turned on. The area of metals under the electrodes become plastic and squeeze the metals into each other. The electrode pressure is maintained for a few seconds with the help of a timer.

### **Detailing of practicals**

Identification of items such as Flux, anti flux, Dental solders, spot welder

Fabrication of molar bands using spot welders

### **Assessment activities**

Clinic visit

Fabrication of molar bands

Seminar presentation

Quiz

### **Sample Questions**

1. What is a flux? What are the different types of flux.
2. What are the applications of solder in dentistry.
3. Write the procedure of free hand soldering.
4. Write the use of the following
  - a) Flux
  - b) Antiflux
  - c) Solder
5. The components of the flux given to be
  - i) Borax glass (55%)
  - ii) Boric acid(35%)
  - iii) Silica(10%)

- a) Identify the flux and its use.
- b) Mention the other type of flux used and its use.
6. Identify the flux and its use.
7. Write a shortnote on soldering and welding.
8. Explain in detail the steps you undergo while repairing a broken adams clasp of a removable orthodontic appliances.
9. Identify the items-Flux, antifix.
10. Define soldering

### **Extended activities**

1. Conduct dental camps in schools and other residential areas in collaboration with local dental association branches. Learners can participate in organizing and observe camp activities.
2. The learners can be given postings in the licensed and established dental clinics for observation in various departments in holy days.
3. Can conduct home visits and communicate the details of advanced dental treatments with public.

### **Detailing of practicals unit wise**

#### **Unit. 4.1**

1. Preparation of Orthodontic Cast
2. Straightening of wire
3. Making of Square
4. Making of Triangle
5. Making of Semi circle
6. Making of Circle
7. Making of 'U'Loops, 'V'Loops, U-V Loops

#### **Unit. 4.2**

- 1) Spotters identification

#### **Unit.4.3**

1. Identification of active and retentive components in the given removable orthodontic appliance.

2. Fabrication of Adams clasp
3. C clasp
4. Z Spring
- 5.. Finger spring
6. Coffin Spring
7. Labial bow (Long and short)
8. Fabrication of appliances in cases like

**Unit. 4.4**

1. Identification of different myofunctional appliances
2. Fabrication of oral screen

**Unit. 4.5**

1. Identification of appliances
2. Can assist in dental labs in the fabrication

**Unit. 4.6**

1. Identification of different habit breaking appliances.
2. Fabrication of oral screen.
3. Fabrication of tongue guard appliance

**Unit. 4.7**

1. Fabrication of Hawley's retention appliances
2. Spotters

Identification of different types of retention appliances

**Unit. 4.8**

Role Play.

1. Identification of instruments used in dental clinic.
2. Identification of different dental x-rays.

**Unit. 4.9**

1. Identification of items such as Flux, antflux, Dental solders, spot welder
2. Fabrication of molar bands using spot welders

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