

**PREVENTION AND MANAGEMENT OF FREQUENT IATROGENIC  
DAMAGE IN THE PREPARATION OF ABUTMENT TOOTH  
PROCEDURES IN FIXED PARTIAL DENTURE**

**LITERATURE REVIEW**



**THESIS**

*Submitted to Complete One of the Requirements for  
Achieving a Bachelor's Degree in Dentistry*

**ARRANGED BY**

**ANDI ADELYA YAYA DHARMAN**

**J011191031**

**DEPARTMENT OF PROSTODONTICS**

**FACULTY OF DENTISTRY**

**HASANUDDIN UNIVERSITY**

**2022**

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**Judul : Prevention and Management of Frequent Iatrogenic Damage in The Preparation of Abutment Tooth Procedures in Fixed Partial Denture**

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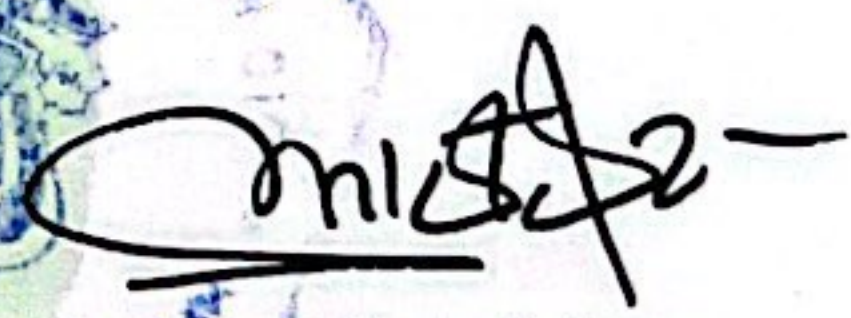
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Makassar, 28 Oktober 2022

Penulis,



**PREVENTION AND MANAGEMENT OF FREQUENT IATROGENIC DAMAGE  
IN THE PREPARATION OF ABUTMENT TOOTH PROCEDURES IN  
FIXED PARTIAL DENTURE**

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Hasanuddin University**

**ABSTRACT**

**Background:** In dentistry, dentists have to work in a small area that allows iatrogenic damage to occur during the preparation of abutment denture bridges, these damages can occur in adjacent teeth, soft tissues, and pulp. Prevention of damage and the need for handling if iatrogenic damage occurs need to be considered because it will affect the success of treatment and hinder the maintenance of dental health in the long term.

**Objective:** This literature review aims to determine the types of iatrogenic damage that often occur in the preparation of tooth abutments procedures and their prevention and management. **Results:** The reviewed journals found that the highest prevalence of iatrogenic damage occurred on the proximal surfaces of adjacent teeth. Prevention can be done using rubber dams and matrix bands, making thin "lip" of enamel, mouth mirrors, and dental loupes. To treat this iatrogenic damage, polishing can be done with a soft-lex disc, composite resin, surgical crown lengthening and orthodontic extrusion.

**Conclusion:** This review shows that iatrogenic damage to adjacent teeth is the most common iatrogenic error in the preparation of denture bridge abutments. The use of matrix bands, rubber dams, mouth mirrors, the manufacture of thin "lip" of enamel, and dental loupes can be used to prevent iatrogenic damage in abutment preparation procedures. Composite resins and soft-lex discs can be used to treat damage to rough tooth surfaces,

**Keywords:** prevention, management, iatrogenic damage, accidental, abutment preparation, fixed partial denture, dental bridge.



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# CHAPTER I

## INTRODUCTION

### 1.1 Background

Dental and oral health is very important for physical health and quality of life because dental and oral health will affect overall physical and psychological health.<sup>1</sup> As people age, the risk of tooth loss increases.<sup>2</sup> Tooth loss can cause changes in the appearance of a person's face and interfere with functional and physiological functions, so it can affect a person's psychosocial aspect. This situation has an impact on the need for prosthetic care that aims to prevent or improve the decline in oral health and quality of life

The use of a dental bridge is a treatment carried out to meet the patient's needs in aesthetic and functional aspects in the event of partial tooth loss. Dental bridges with poor abutment teeth preparation will lead to inadequate marginal fit, and plaque control will become more difficult. In dentistry, dentists have to work in a small working area that allows iatrogenic damage to occur during the preparation of abutment dental bridges. Iatrogenic damage are errors produced either by accident or as a result of negligence by the operator.<sup>6</sup>

According to PV Harish, et al, these damages can occur in adjacent teeth, soft tissues, and pulp. It will result in damage to adjacent tooth surfaces or proximal surfaces. This damage will be more prone to accumulation of plaque, causing caries on the teeth, then will cause inflammation of the gingiva and degeneration of the pulp. Prevention of damage and the need for handling if iatrogenic damage occurs need to be considered because it will affect the success of treatment and hinder the maintenance of dental health in the long term.<sup>5</sup> Therefore, the authors are interested in knowing and studying further about frequent types of iatrogenic damage during abutments tooth preparation procedure and how to manage and prevent them.



## **1.2 Problem Statements**

1. What is the most common iatrogenic damage in the preparation of dental bridge abutments?
2. How to prevent iatrogenic damage in the preparation of abutment dental bridges?
3. How to manage iatrogenic damage that occurs in the preparation of abutment dental bridge procedures?

## **1.3 Objectives**

1. Knowing the types of iatrogenic damage that often occur in the preparation of dental bridge abutment tooth procedures.
2. Knowing how to prevent iatrogenic damage in the preparation of dental bridge abutment tooth procedures.
3. Knowing the management of iatrogenic errors that can occur in the procedure for the preparation of abutment dental bridges.



## **1.4 Benefits**

### **1.4.1 Theoretical Benefits**

It is hoped that it can be used as learning material to learn more about the studies discussed and can be a reference for other writing.

### **1.4.2 Benefits for Clinicians**

It is hoped that it can be used as a basis in health services to improve dental and oral health, especially in prosthodontics.



## CHAPTER II

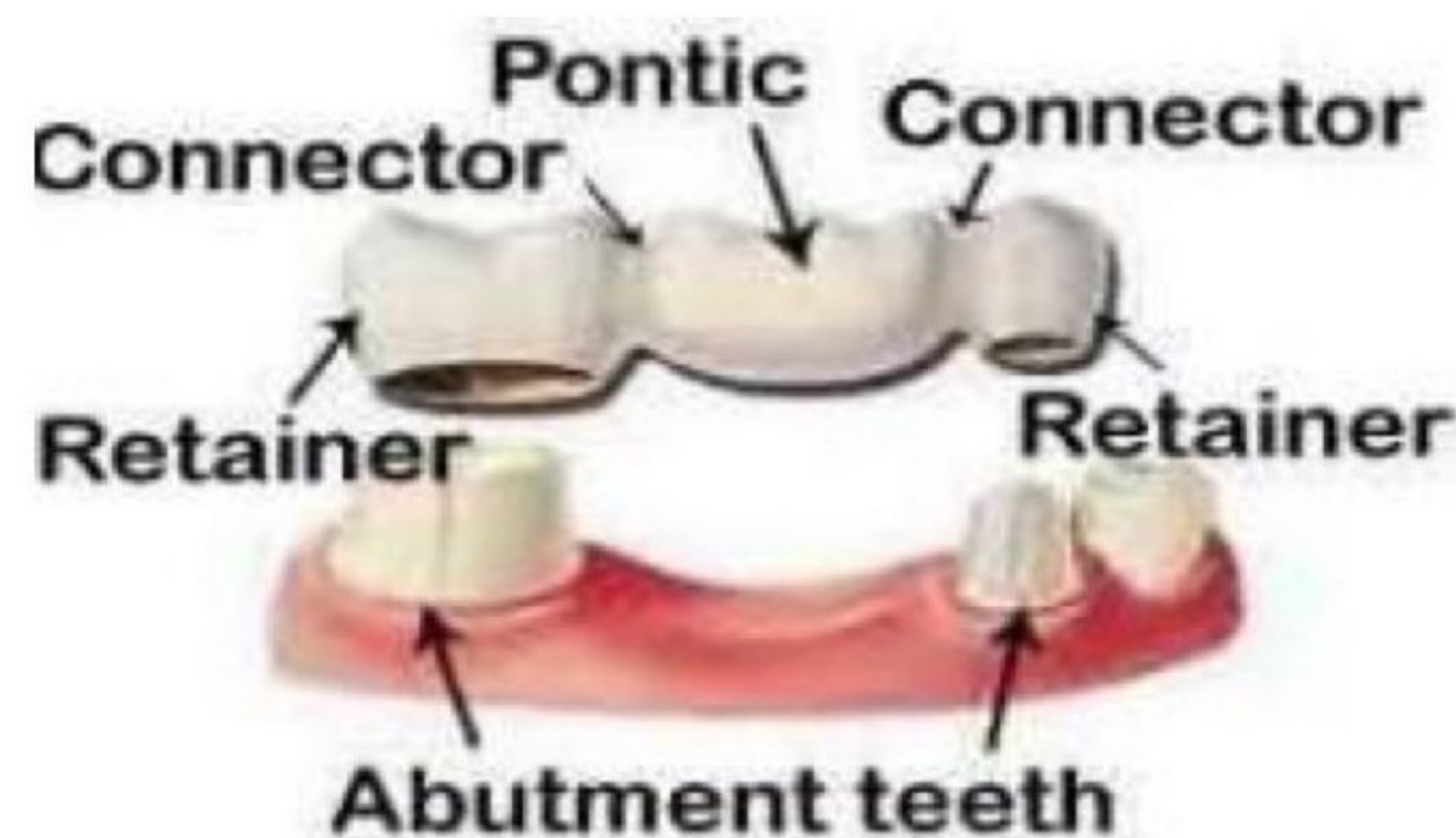
### LITERATURE REVIEW

#### 2.1 Dental Bridge

##### 2.1.1 Definition of Dental Bridge

Dental bridges are dentures that are permanently cemented to natural teeth or implants that aim to replace the loss of one or more teeth and also to restore masticatory function, phonetic function, and aesthetics. Consists of a retainer that supports abutment teeth, pontics to replace missing teeth, and connectors to connect pontics and retainers.<sup>7,8,9</sup>

Figure 2.1 Bridge denture components



Source: Sehgal, apoorva., Jhanwar bhara., Gilhotra.K U. Research Article Research Article. Arch Anesthesiol Crit Care. 2018;4(4):51.

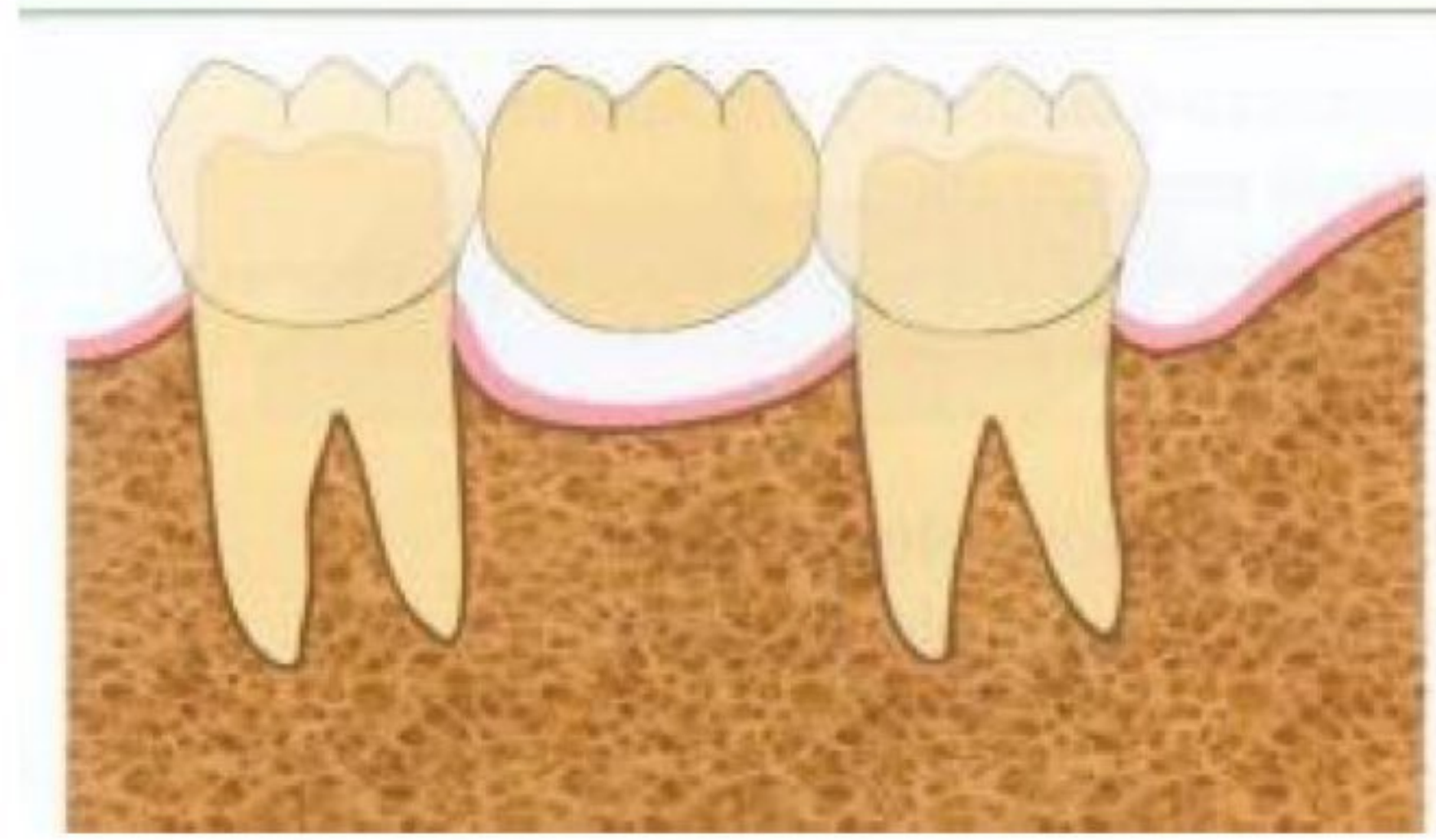
##### 2.1.2 Types of Dental Bridges

Several types of dentures are used for the treatment of missing teeth, namely:

###### 1. Fixed-fixed Bridge

Fixed-fixed bridge is the type of dental bridge treatment that is most often performed on patients with partial tooth loss, this type of denture is a fixed denture with a rigid connector on the pontic that is permanently attached to two or more abutment teeth. Provides excellent stability and strength and can also distribute pressure more evenly.<sup>11</sup>





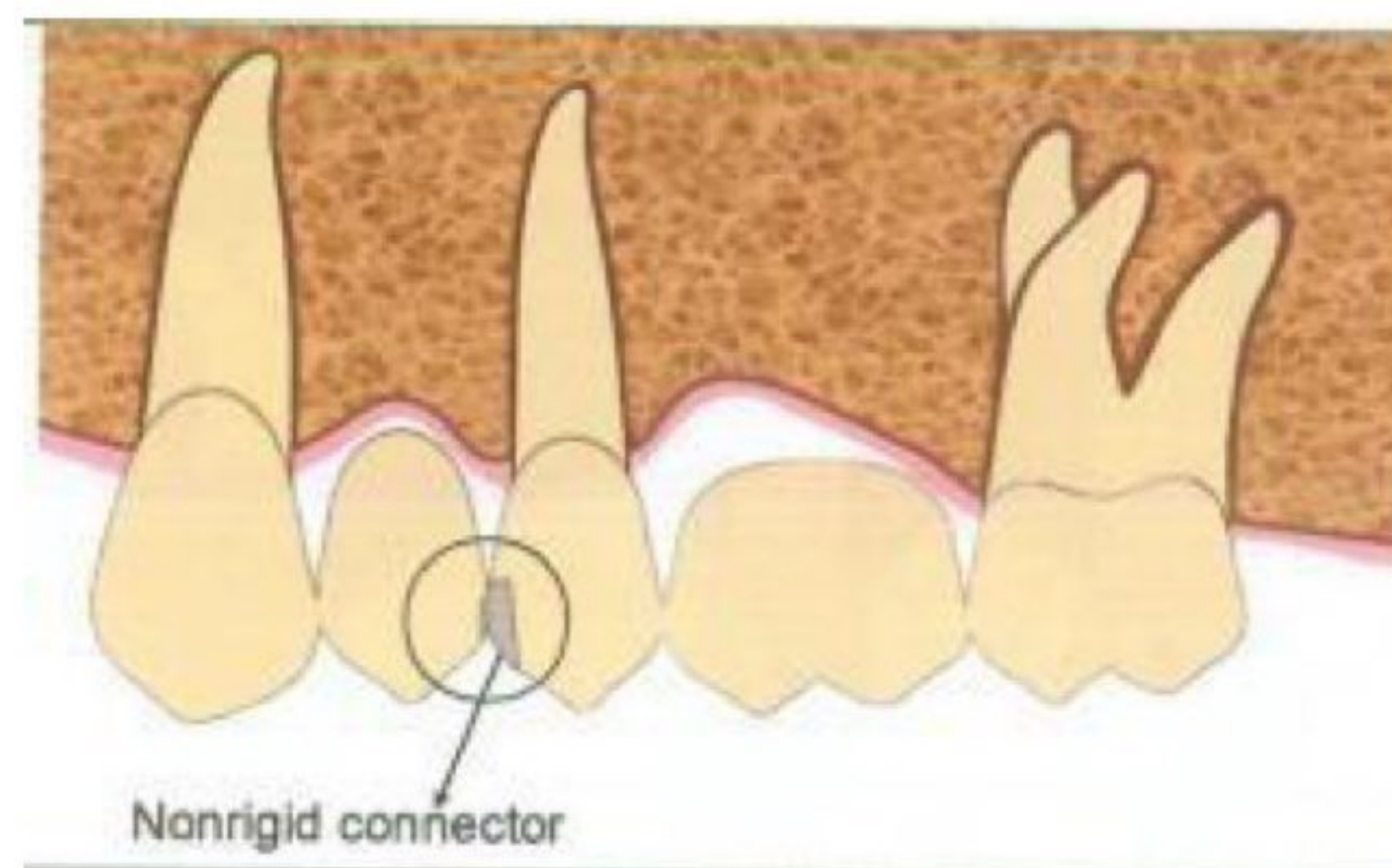
**Figure 2.2**Fixed-fixed Bridge

**Source:**Nallaswamy D. Textbook of Prosthodontics. 2nd ed. India : Jaypee Brother Medical.

2017; p 783

## 2. Semi fixed Bridge

This semi-fixed bridge has a design with one connector that is non-rigid and rigid on the other, allowing limited movement of the connector between the pontic and retainer. One of the abutment teeth will resist the intracoronal attachment to allow a small degree of movement between the rigid component and the other abutment teeth.<sup>12</sup>



**Figure 2.3**Semi fixed Bridge

**Source:**Nallaswamy D. Textbook of Prosthodontics. 2nd ed. India : Jaypee Brother Medical.

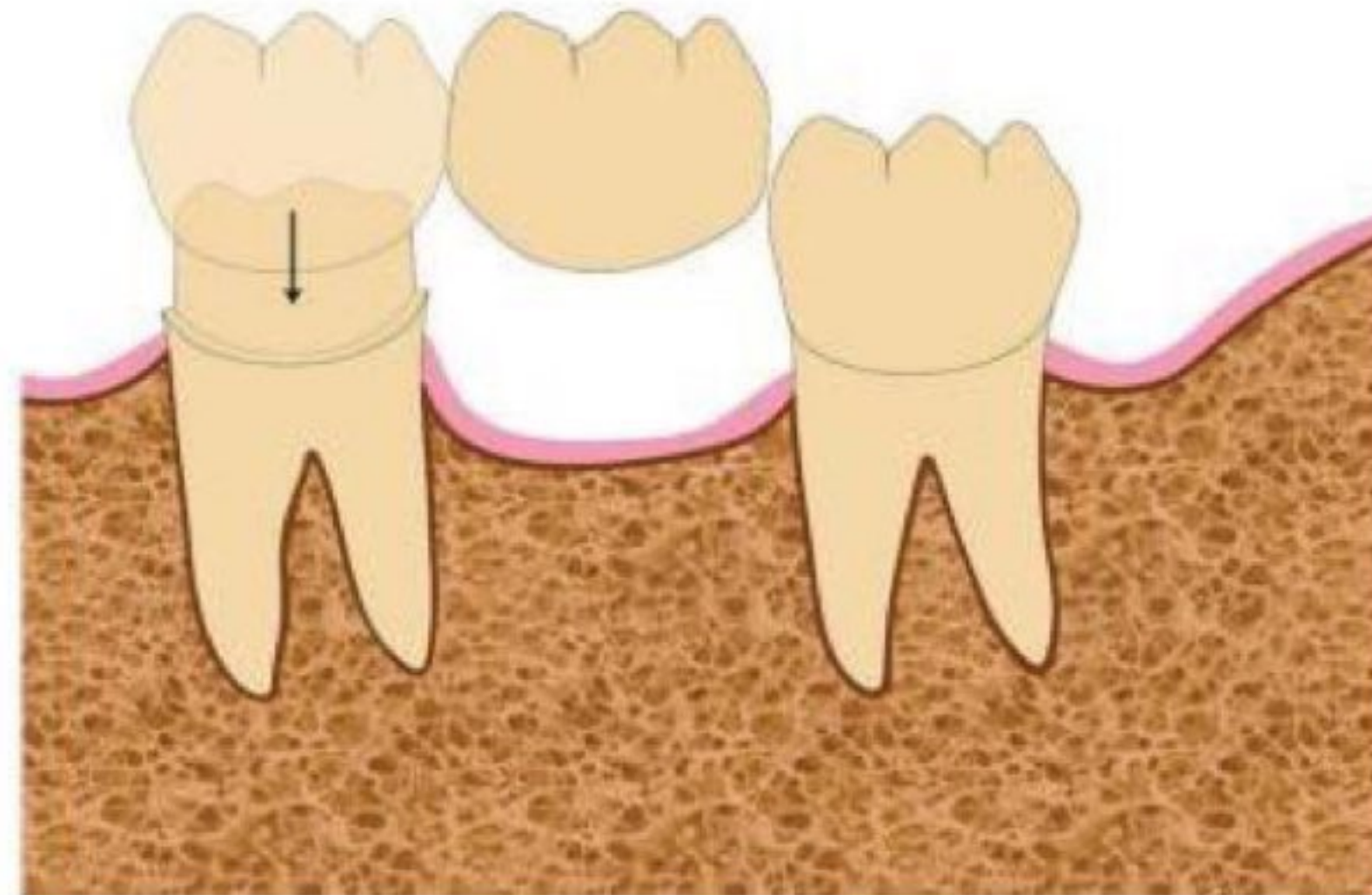
2017; p 782

## 3. Cantilever Bridge

This dental bridge is a fixed bridge to replace one missing tooth and is supported by only one side of the abutment teeth, the cantilever design has a risk of periodontal disease and cementation failure of the abutment teeth, so its use is indicated only for teeth that receive relatively light occlusal loads such as replacing a missing anterior



tooth.<sup>13</sup> Due to the simple design of this denture bridge, the preparation time required is relatively short and allows the tooth to be prepared to a minimum.<sup>14,15</sup>



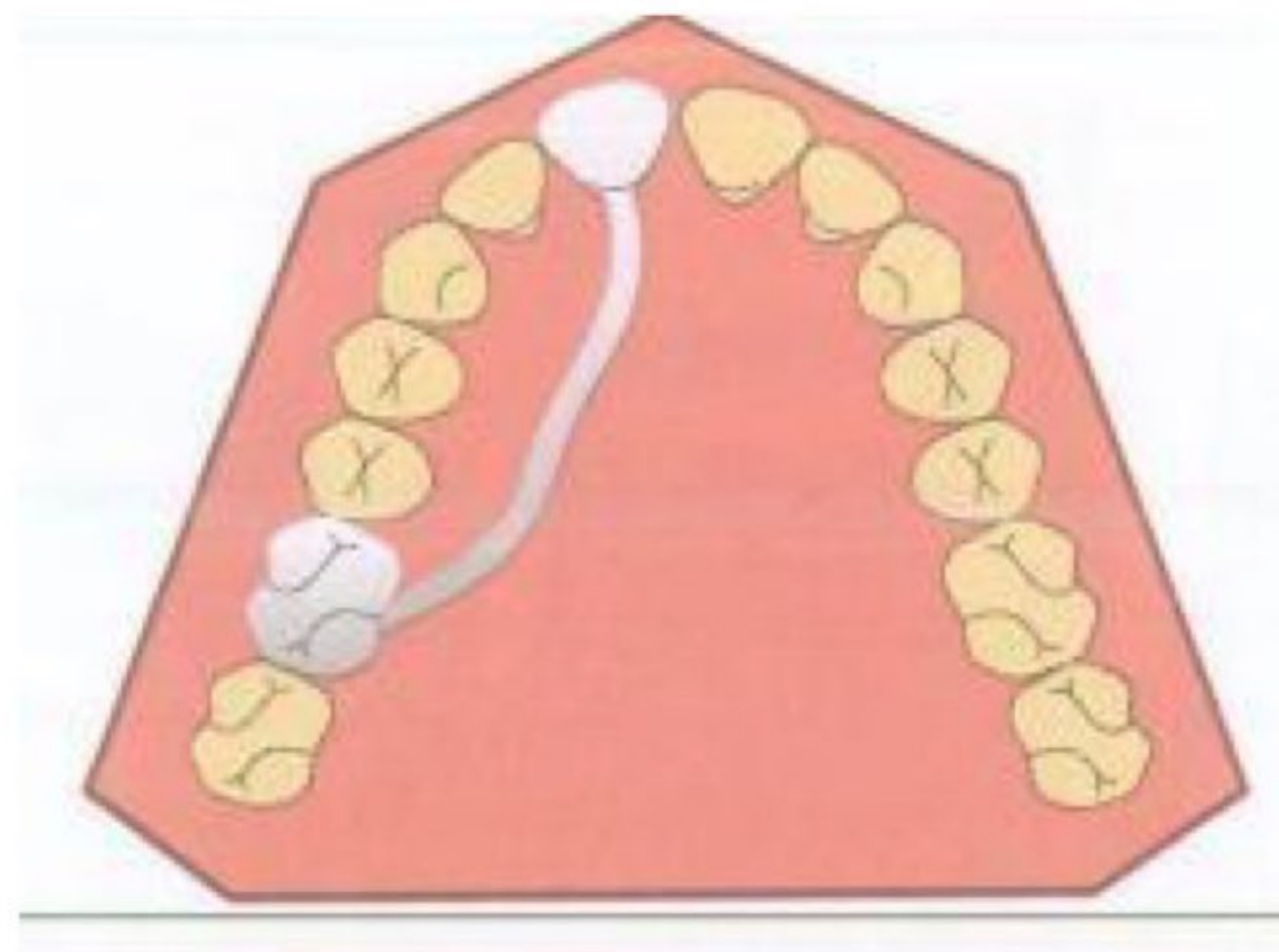
**Figure 2.4**Cantilever Bridge

**Source:**Nallaswamy D. Textbook of Prosthodontics. 2nd ed. India : Jaypee Brother Medical.

2017; p 782

#### 4. Spring Cantilever Bridge

This spring cantilever bridge uses teeth and tissue as support, the pontic is supported by a long connector connected to the abutment teeth so that the masticatory pressure that should be received by the pontic will be absorbed by the mucoperiostium. Because the connector is on the palate, the use of this spring bridge denture has good aesthetics.<sup>13</sup>



**Figure 2.5**Spring Cantilever Bridge

**Source:**Nallaswamy D. Textbook of Prosthodontics. 2nd ed. India : Jaypee Brother Medical.

2017; p 783



### **2.1.3 Indications and Contraindications for Dental Bridge**

Indications:

1. Short edentulous arch
2. Sufficient crown height to provide retention<sup>16</sup>
3. There are healthy teeth that can be used as abutments near the edentulous space
4. Abutment teeth and supporting tissues are healthy
5. When the patient wants a fixed prosthesis<sup>9</sup>

Contraindications:

1. Young teeth with a large pulp space
2. Having periodontal problems
3. Long edentulous arch<sup>16</sup>
4. Bad email condition
5. The patient has poor oral hygiene<sup>9</sup>

## **2.2 Abutment Tooth Preparation**

### **2.2.1 Principles of Abutment Tooth Preparation**

The principle of preparation of abutment denture bridge can be divided into three, namely:

#### **a. Biological Considerations**

One of the basic principles of restorative dentistry is to maintain as much tooth structure as possible and avoid excessive cutting of tooth structure, as this will interfere with the health of the abutment tooth and other supporting tissues. Excessive cutting of the tooth structure causes thermal hypersensitivity, pulp inflammation that can lead to pulp necrosis, then the tooth is too tapered or too short will affect the retention and resistance of the prepared tooth. Poor preparation will lead to inadequate marginal fit or lack of contour,



plaque control around the dental bridge will become more difficult and hinder the maintenance of dental health in the long term.

#### 1.) Axial reduction

Inflammation of the gingiva is generally associated with the excessive axial contour of the abutment teeth because it makes it more difficult for the patient to maintain plaque control around the gingival margin. A good tooth preparation should have sufficient space to obtain a good axial contour, allowing the meeting between the restoration and the tooth to be smooth.

#### 2.) Preparation of Edge Placement

The margin for tooth preparation should be supragingival as much as possible. Restorations cemented at the subgingival margin will disrupt the epithelial attachment and promote periodontal disease. Supragingival preparations are also easier to prepare without causing trauma to the soft tissues.

#### 3.) Adaptation margin

The dissolution of the luting agent and the roughness of the cement make the attachment between the restoration cementation and the tooth always have the potential for caries recurrence. The more accurately the restoration is adjusted to the tooth, the lower the likelihood of recurrent caries and periodontal disease.

#### 4.) Occlusal considerations

A satisfactory preparation should allow sufficient space for the development of a functional occlusal scheme in the completed restoration.

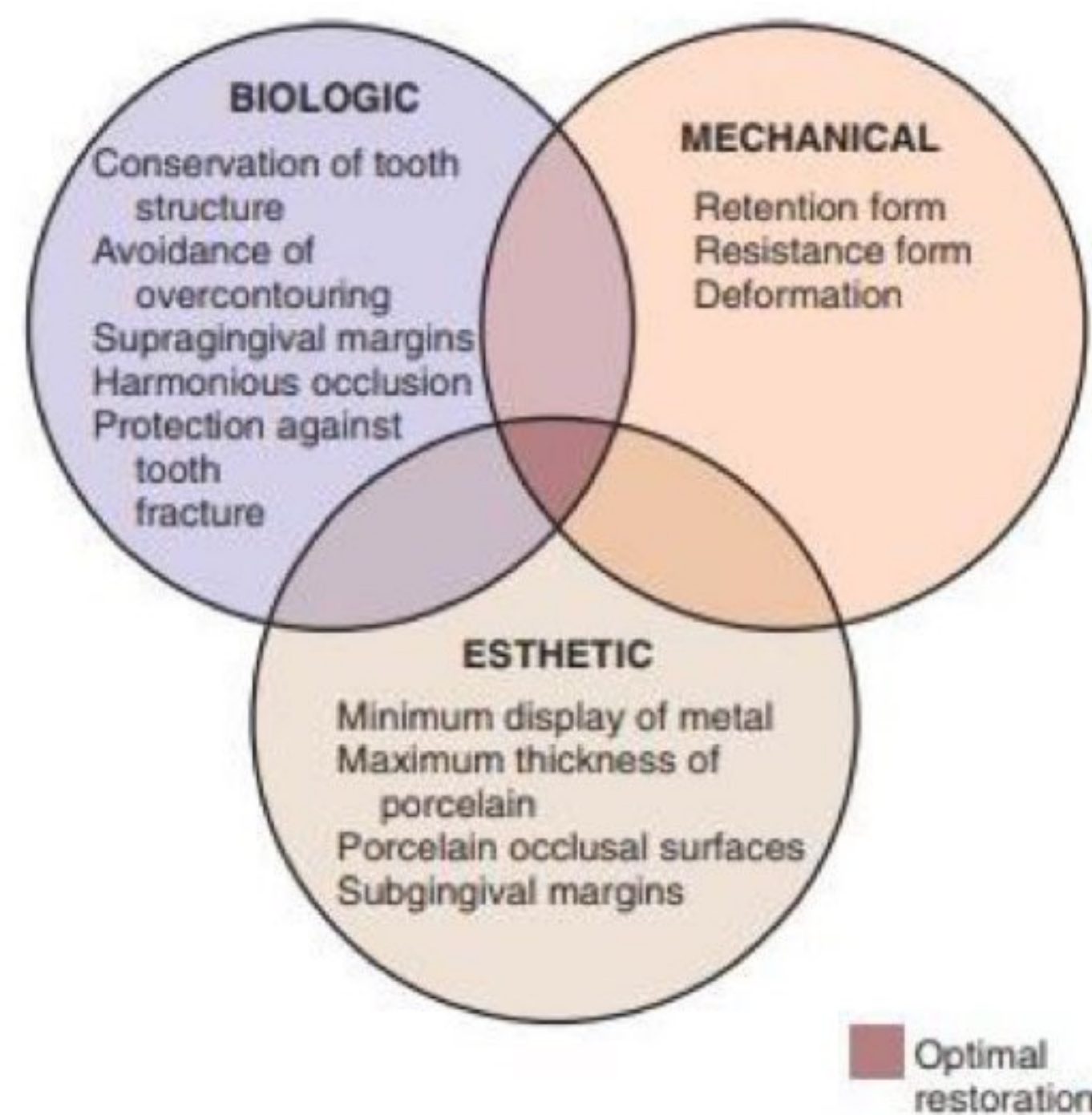


## b. Mechanical Considerations

The preparation of abutments must meet mechanical considerations because the restoration can be dislodged, distorted, or fractured. These mechanical considerations can be divided into three categories: providing retention form, resistance form, and deformation of the restoration. To provide adequate retention and resistance to the retainer, the abutment teeth must have a long and parallel axis, and then the connector must have sufficient strength. Also, the pontic must resemble the anatomical shape of the natural tooth and be strong in order to withstand the chewing load.<sup>17</sup>

## c. Aesthetic Considerations

The patient's need for restorations resembling natural teeth is increasing, so bridge dentures are often chosen because of their convenience and long-term results. This can be achieved by minimizing the appearance of metal, providing maximum thickness to the porcelain material, thereby increasing the shadow or color of the restoration, and choosing the right color.<sup>6</sup>



**Figure 2.6**Biological, mechanical and aesthetic requirements.

**Source:**Rosenstiel SF, Land MF, Fujimoto J. Contemporary Fixed Prosthodontics, 5th Ed. New York: Mosby Elsevier; 2016 :210

### 2.2.2 The Abutment Tooth Preparation Stage

Preparation of abutment teeth in a 3-unit bridge denture is done to prepare the abutment teeth as retainers. The procedure for preparing



abutment teeth for bridge dentures is as follows:

- 1.) Outline the guide groove for the first molars and first premolars to a depth of 1 mm using a round-end tapered diamond bur in the central, mesial, and distal fossae of the occlusal plane and the relationship to form a channel along the inner groove (central groove) to extend to the distal and mesial marginal ridges.



**Figure 2.7** Placement of guiding grooves on the occlusal surface

**Source:** Rosentel SF, Land MF, Junhei MF. Contemporary Fixed Prosthodontics. 5th Ed. St. Louis: Morby, Inc. 2016. P 262

- 2.) Make grooves with a depth of 1 mm using the same bur on the teeth' buccal and lingual developmental grooves as well as on each triangular ridge, starting from the top of the cusp to the base of the cusp.
- 3.) In the occlusal area in contact with the occlusal tooth of the antagonist, make a groove 1 mm deep and position the drill bit at a 45 degree angle to the tooth axis so that a bevel is formed on the functional cusp.





**Figure 2.8**(a) The position of the bur blade at 45 degrees angulation to the tooth axis (b) Preparation Results

**Source:**Rosentiel SF, Land MF, Junhei MF. Contemporary Fixed Prosthodontics. 5th Ed.St.Louis:Morby.Inc.2016.P 264

- 4.) Reduce the occlusal plane of the remaining tooth structure between the guide grooves using a tapered diamond round-end bur, gradually reducing the mesial side first and the distal side as a guide or vice versa. Then reduce the distal side of the occlusal plane when the mesial side has been completed.

**Figure 2.9**Gradual reduction of the occlusal plane



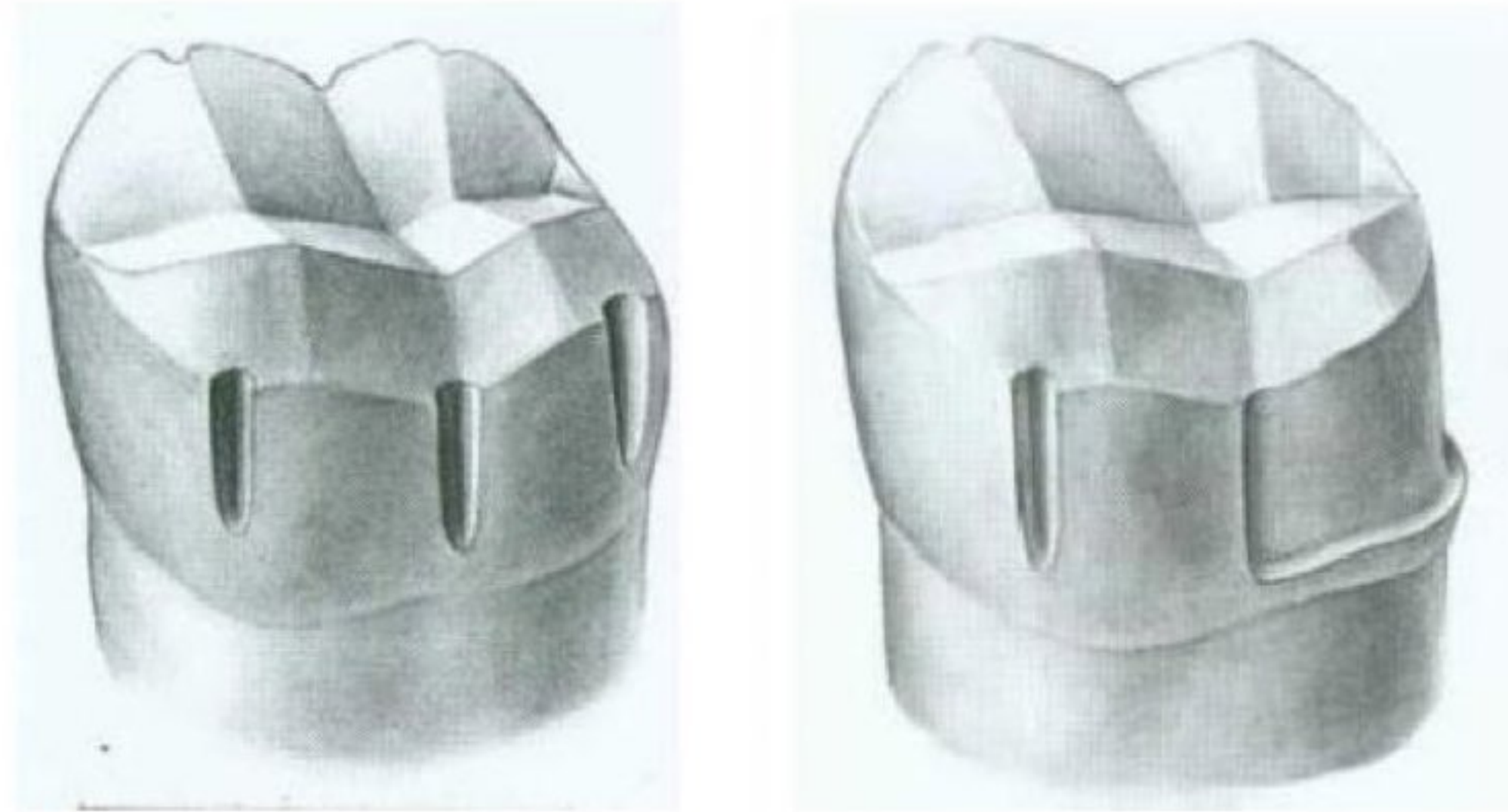
**Source:**Rosentiel SF, Land MF, Junhei MF. Contemporary Fixed Prosthodontics. 5th Ed.St.Louis:Morby.Inc.2016.P 263

- 5.) Checking for centric occlusion using articulating paper. If an area is affected by dark spots, then the area is reduced again until the spot does not appear when checking for centric occlusion.
- 6.) Checking on the results of the preparation, the surface of the preparation results should not have sharp angles or uneven surfaces.



7.) Creating guide grooves for axial plane reduction

8.) Performing a reduction in the axial plane and creating a chamfer



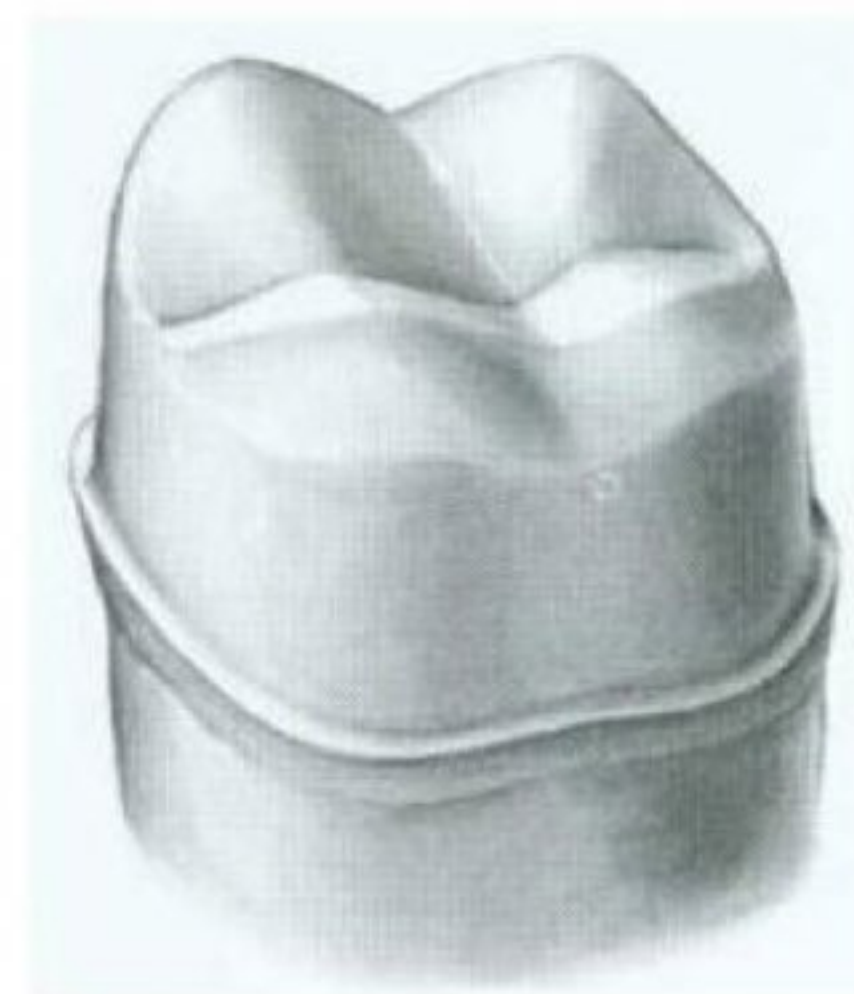
**Figure 3.0**(a) Axial plane guide groove (b) Axial plane reduction

**Source:**Rosentiel SF, Land MF, Junhei MF. Contemporary Fixed Prosthodontics. 5th Ed.St.Louis:Morby.Inc.2016.P 265

9.) Examining the results of the preparation, which aims to evaluate the alignment of the results of the tooth preparation, the presence of over contours or under contour as well as the presence of undercuts. Performed visually or see with one eye with a viewing distance of approximately 30 cm or with the help of a straight sonde.

10.)Finishing was done using a fine finishing torpedo bur to smooth the prepared tooth surface and chamfer margins.

11.) Dochecking the surface of the prepared tooth and the chamfer margin using a probe, the tooth surface must be smooth.<sup>17</sup>



**Figure 3.1**Finished preparation results

**Source:**Rosentiel SF, Land MF, Junhei MF. Contemporary Fixed Prosthodontics. 5th Ed.St.Louis:Morby.Inc.2016.P 268



## 2.3 Types of Iatrogenic Damage

The term iatrogenic refers to the damage that results from the procedures doctors perform on their patients, this is very important to prevent pain or harm to the patient and provide the best possible care. During abutment preparation, iatrogenic damage occurs due to the patient's sudden movement during the procedure or the operator accidentally slipping the instrument. Iatrogenic damage during the preparation of abutment dental bridges are common in:

### 1. Adjacent teeth

Iatrogenic damage in adjacent teeth are the most common errors in dentistry, these errors usually occur in the proximal contact area and the middle third of the crown of the tooth in the form of a vertical groove with a width of up to 1 mm, fine scratches, or with extensive damage.<sup>6</sup> This is presumably because the enamel surface contains a higher concentration of fluoride and the damaged layer is more prone to plaque retention.<sup>18</sup> Also, enamel damage on the proximal surface will appear as radiolucency, so this damage can be mistaken for diagnosis as a carious cavity.<sup>19</sup>

### 2. Soft tissues

Iatrogenic damage of the cheeks, lips, and tongue occur during the preparation of abutments, and damage to the tongue occurs when the lingual surfaces of the mandibular molars are being prepared.<sup>6</sup> Later damage to the cheeks and lips occurs when the operator does not retract enough using a mouth mirror during preparation. This iatrogenic damage results in the formation of soft tissue ulcerations, but these ulcerations heal on their own in a short time.<sup>19</sup>

### 3. Pulp

In tooth preparation it is necessary to consider the morphology of the pulp chamber because its size decreases with age. Taking too much tissue or preparing too deep can result in pulp degeneration during or after the preparation, especially in newly opened dentinal tubules.<sup>6</sup> The fatal thing



that can happen is perforation of the pulp chamber, which causes bacteria from the oral cavity or periodontal tissue to enter the pulp. This pulp chamber perforation will cause pulp necrosis and affect the success of prosthodontic treatment.<sup>20</sup>

#### 4. Periodontal Tissue

Biological width is the dimension of space occupied by healthy gingival tissue that lies above the alveolar bone, this biological width acts as a barrier to prevent the entry of microorganisms into the periodontium. The most common iatrogenic damage is when preparation into the subgingival margin, the margin that is too far below the gingival crest tissue will interfere with the gingival attachment re-adhesion occurs. This is thought to be due to a destructive inflammatory response to microbial plaque located in deep periodontal pockets or gingival recession.<sup>6</sup>

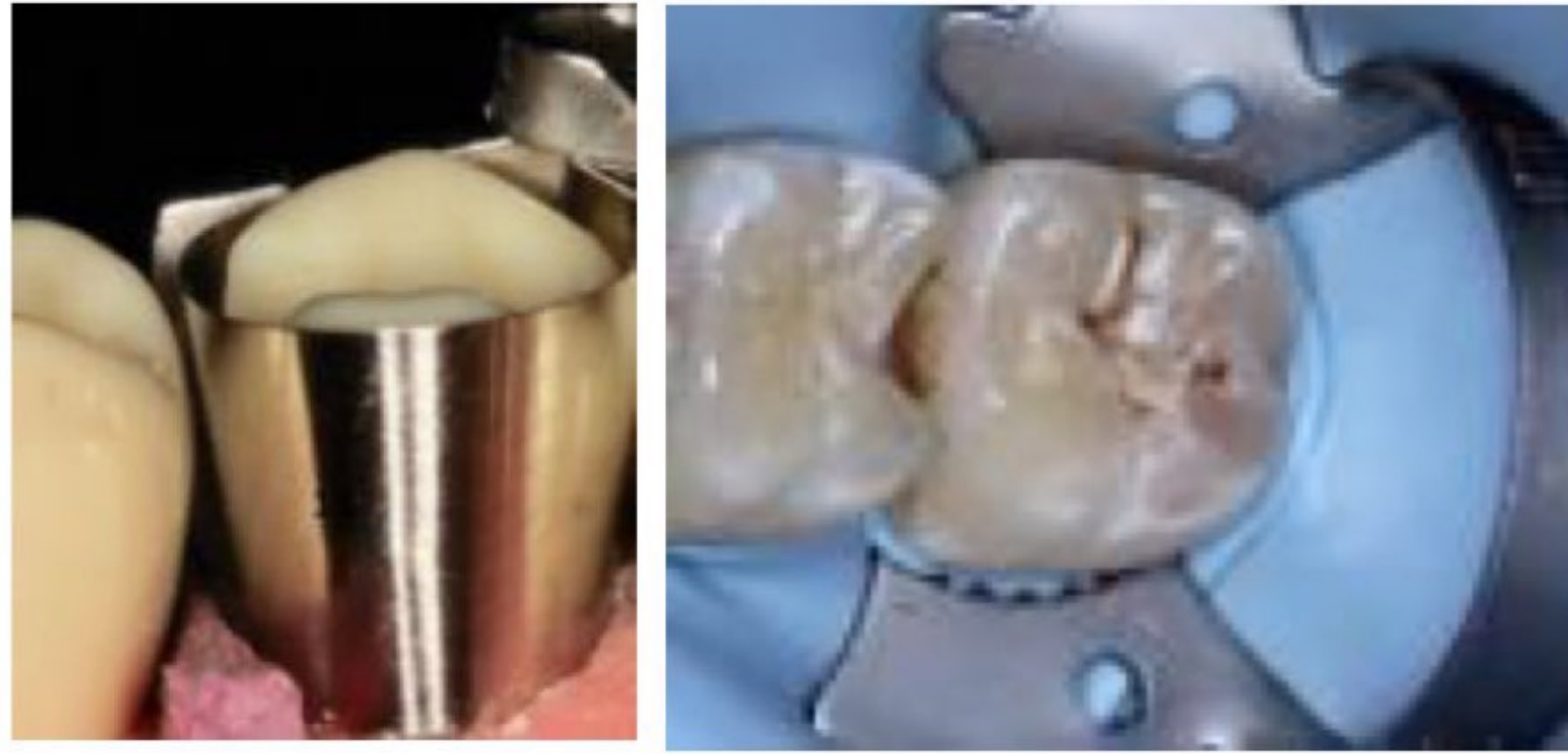
#### **2.4 Iatrogenic Damage Prevention**

The tooth preparation process is generally carried out using high-speed rotary instruments, the safe and effective use of these instruments depends on the accuracy of the operator's visual field and the skillful ability of the hands to control the movement of the instrument in a narrow oral cavity.<sup>21</sup> These errors can be prevented by:

##### 1. Use of matrix band and rubber dam

The use of a matrix band or rubber dam around adjacent teeth, especially in the proximal area, will provide access to a wider field of view and easier access to the contact area, although it can still be perforated and result in damaged tissue being coated.<sup>22</sup> However, the placement of the matrix band or rubber dam errors often occur during the procedure, with the limited number of clamp sizes often clamping the rubber dam damaging the gingiva and eroding the cementum and root surface resulting in inflammation of the gingiva.<sup>6</sup>





**Figure 3.2**(a) Use of matrix bands (b) Rubber dam

**Source:**Mackenzie L, Bonsor S, Waplington M. Splendid Isolation: A practical guide to the use of rubber dam part 2. Dent Update. 2020;47(8):636.

Bailey O. Sectional matrix solutions: the distorted truth. Br Dent J. 2021;231(9):547.

## 2. Creating thin “lip” of enamel as the bur passes proximal contact

The operator must be careful in using the bur to avoid damage to the surrounding tissue. The use of a small diameter diamond bur instrument can also help prevent iatrogenic damage to adjacent teeth. In addition, creating a “lip” on the enamel helps reduce the excessive reduction of tooth structure.<sup>6</sup>



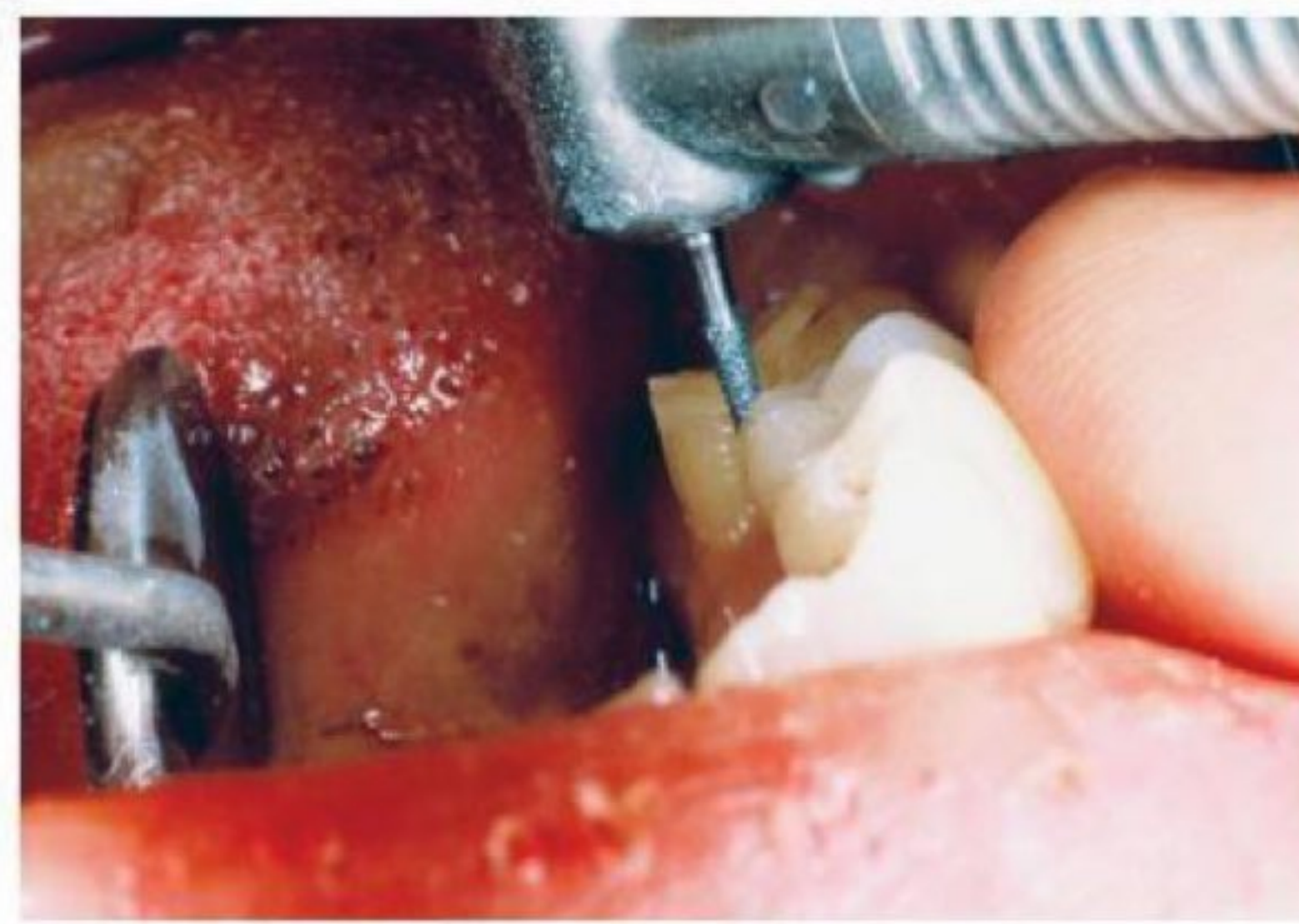
**Figure 3.3**Making thin “lips” on email

**Source:**Rosentiel SF, Land MF, Junhei MF. Contemporary Fixed Prosthodontics. 5th Ed.St.Louis:Morby.Inc.2016.P 210



### 3. Use of mouth mirror

Soft tissue damage is common in the cheeks, lips, and tongue. This damage can be prevented by careful retraction and using a mouth mirror during the preparation procedure. Care must be taken to prepare mandibular molars to avoid damage to the tongue.<sup>6</sup> The risk of iatrogenic damage to the pulp can be reduced by considering appropriate techniques and materials. In addition, considering the morphology of the pulp can also reduce the risk of inducing damage to the pulp.<sup>23</sup>



**Figure 3.4** Mouth mirror protects soft tissue.

Source: Rosenstiel SF, Land MF, Fujimoto J. Contemporary Fixed Prosthodontics, 5th Ed. New York: Mosby Elsevier; 2016 :211

### 4. Use of bite block

The purpose of using a bite block is to keep the mouth open during the abutment preparation procedure. Isolation by using a bite block during the abutment preparation procedure was carried out to prevent iatrogenic errors when the patient suddenly moved, causing damage to adjacent tissues caused by the instrument. In addition, this tool can also keep the tooth to be prepared dry during the procedure because the saliva ejector can be positioned easily.<sup>24</sup>



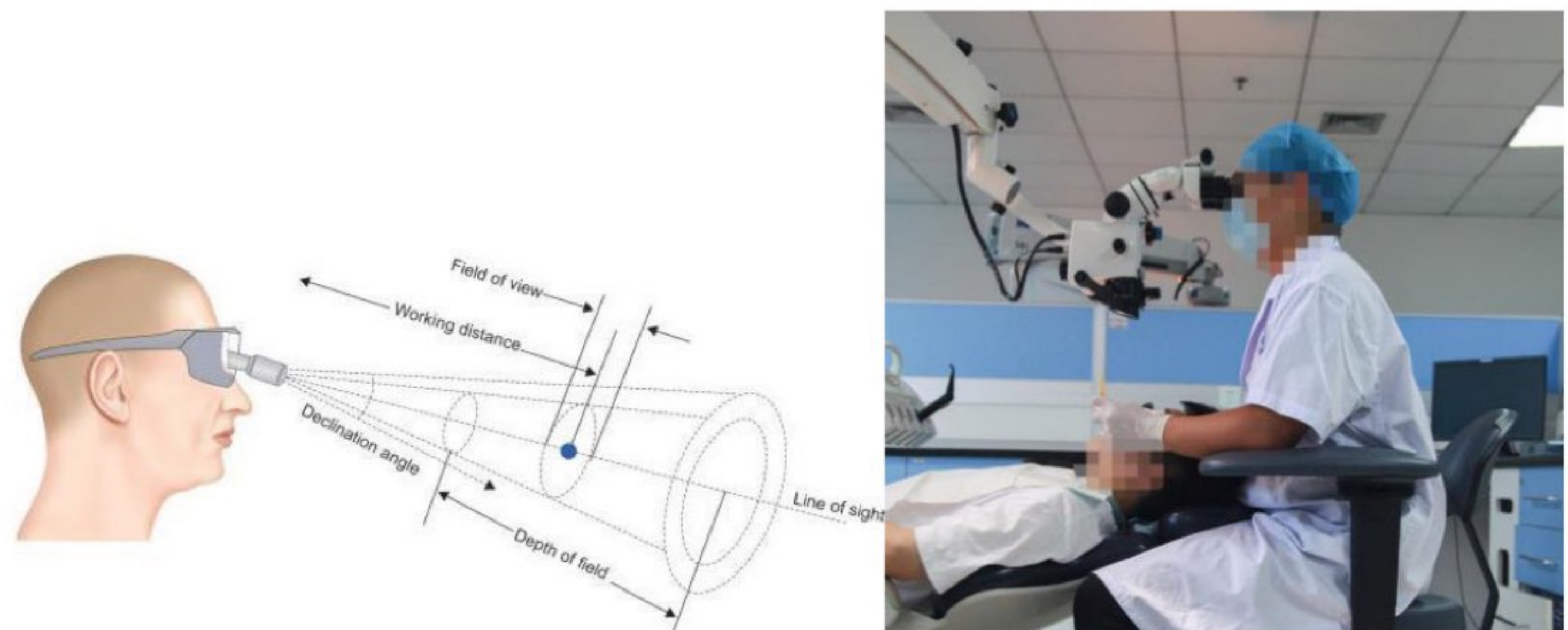


**Figure 3.5** Use of bite block

**Source:** Jawa A, Srinivasan I. Comparison of Optragate and Conventional Bite Block as Mouth Opening Aids in Children. *J Dent Med Sci.* 2016;15(10):45.

### 5. Use of dental loupes and dental microscopy

The varying depths of iatrogenic damage can sometimes be seen with the naked eye. Therefore, the use of dental loupes can help avoid this damage. Dental loupes can provide significant magnification to increase the operator's field of view accuracy.<sup>7</sup> The use of a microscope provides not only visual benefits to the dental clinician but also provides proper posture in accordance with ergonomic principles, even the use of this microscope can increase concentration and improve preparation results.<sup>25</sup>



**Figure 3.6** Features of microscopic dental loupe and dental magnifier

**Source:** Aldosari MA. Dental Magnification Loupes: An Update of the Evidence. *J Contempl Dent Practice.* 2021;22(3):311.

Yu H. *Posture and Microscopic View of Prosthodontic Microsurgery.* Singapore: Springer, Digital Guided Micro Prosthodontics 2022 (pp. 43-57).



## 2.5 Management of Iatrogenic Damage

Management of iatrogenic damage is not easy because a multi-disciplinary approach must be taken, namely before the final impression and must consider anatomy, tooth contact, and accessibility in maintaining oral hygiene after the placement of the denture bridge. The following is a treatment that can be done if an iatrogenic damage occurs during the preparation of the dental bridge.

### 1. Soft-lex disc™

Treatment of iatrogenic damage depends on the amount or extent of tooth structure damage. If the damage is only superficial, then using a soft-lex disc™ is an option to reduce the surface roughness of the teeth to prevent plaque accumulation, better results are obtained with the application of fluoride, and the surface produced by this method produces a smoother surface. If damage occurs to the surface of a restored tooth or minor damage, the surface is re-polished, if the damage is severe the restoration is replaced.<sup>6</sup>



Source: Singh KA, et al. Finishing and Polishing of Restoration-A Review. Int J of Adv Res. 2021; 9(06):107.

### 2. Composite resin

The use of resin is recommended to maintain a rough enamel surface. Nanofill resin with low viscosity can cover rough surfaces such as scratches and flowable composite resin to repair deep damage. The use of this resin must be done properly to avoid trapped air when applied to the



damaged surface. When the damaged tooth surface has caries, a conservative method should be used.<sup>14</sup>

### 3. Surgical crown lengthening

A good understanding of the relationship between periodontal tissues and restorations in dentistry is necessary to ensure teeth' form, esthetics, function, and comfort. If there is a dental restoration without considering the biologic width, the periodontal response will be poor and restoration failure will occur. Subgingival reshaping of the margins was carried out to increase the axial height of the tooth preparation for retention purposes. The disturbed biologic width can be reshaped by surgical removal of the bone away from the restoration margin or by applying orthodontics aimed at extruding the tooth to move the margin away from the bone.<sup>26</sup> Surgical crown lengthening is indicated for preparations that interfere with the biologic width and placement of the margin in the subgingival, it is designed to increase the length of the clinical crown thereby moving the margin away from the bone. Complications that can occur after this procedure are poor esthetics (black triangle), root hypersensitivity, and transient mobility.<sup>14</sup>

### 4. Orthodontic Extrusion

The use of orthodontics aims to stretch the gingival and periodontal fibers resulting in a coronal displacement of the gingiva and bone. Orthodontic extrusion is recommended in anterior areas where crown lengthening cannot be performed, this minimizes gingival recession and bone loss in adjacent teeth. Orthodontic extrusion requires an activation period of 4-6 weeks and a retention period of 6-8 weeks for the tooth to become stable in its new position. Restorative procedures should be postponed until a new gingival gap has developed after periodontal surgery. In the posterior area the location should be evaluated at least 6 weeks postoperatively before the final restorative procedure.<sup>27</sup>