Introduction

- **Goals of Treatment**
  
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  d) Make up of patient psychology  

- **Functions of a RPD**
  
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- **RPD Types**
  
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  e) No abutment tooth posterior to the edentulous area  
  f) Patient desires  
  g) Childhood  
  h) Physically or emotionally handicapped  

- **The Ideal Abutment Tooth**
  
  a) Free from caries or restorations  
  b) Favorably contoured crown  
  c) Crown of adequate length  
  d) Healthy periodontal status  
  e) Long root with large surface area  
  f) Good vertical & horizontal position within the arch  
  g) Stable opposing occlusion
I. THE FIRST DIAGNOSTIC APPOINTMENT

Patient interview:

1. Dental history
2. Diet
3. Habits (Bruxism, Clenching & Thrusting)
4. Expectation of treatment
5. Questions from the patient

Initial examination:

1. Identify conditions requiring immediate attention
2. Evaluation of oral hygiene and caries index.
3. Oral prophylaxis
4. Radiographs
5. Diagnostic impressions and casts

II. THE SECOND DIAGNOSTIC APPOINTMENT

- Introduction

The second diagnostic appointment should be used to complete the collection and evaluation of diagnostic data. A definitive oral examination is essential. The patient's occlusion should be evaluated. Radiograph findings should be correlated with the clinical findings. Medical and dental consultations should be requested if necessary.

The second diagnostic appointment includes:

1. Mounted diagnostic casts
2. Definitive oral examination
3. Consultation requests
4. Development of treatment plane

- Mounted Diagnostic Casts

Mounted diagnostic casts are fundamental diagnostic aids in dentistry (Fig 1). Therefore, mounting procedures should be accomplished with great care. Accurately mounted diagnostic casts may be used in the following ways:

1. Accurately mounted diagnostic casts supplement examination of the oral cavity. Malpositioned teeth, low-hanging tuberosities, compromised interarch space, and defective restorations are readily apparent when accurate casts are correctly mounted on a suitable articulator.

2. Accurately mounted casts permit detailed analysis of a patient's occlusion. Mounted casts permit improved visual access, unimpeded by the patient's lips, cheeks, and
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3. Mounted casts are helpful in patient education. By viewing accurately mounted casts, patients may gain an improved understanding of existing oral conditions, proposed treatment regimens, and potential difficulties.

4. Accurately mounted casts provide a record of the patient's condition before treatment. This record can be of great value if a conflict should arise during the course of treatment.

Fig 1 Accurately mounted diagnostic casts are an essential part of diagnosis and treatment planning.

The primary objective of a diagnostic mounting procedure is to properly position the diagnostic casts on a dental articulator. To accomplish this objective, the casts must be properly related to one another, and to the opening/closing axis of the articulator. For purposes of discussion, a diagnostic mounting procedure may be divided into three distinct phases. These phases may be described as follows:

1. Orientation of the maxillary cast to the condylar elements of an articulator by means of a facebow transfer

2. Orientation of the mandibular cast to the maxillary cast at the patient's centric jaw relation by means of an accurate centric relation record

3. Verification of these relationships by means of additional centric relation records and comparison of occlusal contacts on the articulator with those in the mouth

The first step in a diagnostic mounting procedure involves mounting the maxillary cast on a semiadjustable articulator. The three-dimensional relationship between the patient's maxillary arch and mandibular condyles must be simulated in the diagnostic mounting. To accomplish this, the maxillary cast must be related to the condylar elements of the articulator exactly as the maxillary arch is related to the patient's condyles (Fig 6-2). A facebow transfer provides this orientation.
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- **Definitive Oral Examination**

The oral examination must be thorough. The following steps should be included:

1. A thorough examination of the remaining teeth should be performed. Carious lesions and defective restorations should be correlated with radiographs and other diagnostic findings.

2. A complete periodontal examination should be accomplished. Oral structures should be evaluated to determine pocket depths, mobility, soft tissue attachment, furcation involvement, etc.

3. Teeth with suspected pulpal involvement should be tested for vitality.

4. All remaining teeth should be tested for sensitivity to percussion.

5. The oral tissues should be examined for evidence of pathologic changes.

6. The dental arches should be examined for the presence of tori, exostoses, sharp or prominent bony areas; soft or hard tissue undercuts, and/or enlarged tuberosities.

7. A radiographic examination should be performed with special attention focused on proposed abutments and the residual ridge areas.

8. Mounted casts should be examined for the presence of extruded or malposed teeth, reduced interarch space, unfavorable occlusal planes, and any other potential problems.

9. In mandibular applications, a suitable measuring device such as a periodontal probe should be used to determine the distance from the active floor of the mouth to the gingival margins of the mandibular teeth.

10. The diagnostic casts should be analyzed on a dental surveyor and appropriate removable partial denture designs should be generated.

**Evaluation of diagnostic data**

All diagnostic data must be collected before an effective evaluation can be made. The practitioner must correlate intraoral findings with those of the radiographic survey, the mounted casts, the survey and analysis of the diagnostic casts, and other relevant information. Results should be used in the development of a sound treatment plan.

**Evaluation of carious lesions and existing restorations**

The selection of suitable restorations for partially edentulous patients requires a great deal of thought. A practitioner must examine the remaining teeth for carious lesions. Existing restorations also must be evaluated. The contours of potential abutments should be examined. In addition, the occlusal plane should be evaluated. In some instances, a simple two-surface restoration may be adequate for restoring a carious
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tooth. In other instances, a cast restoration may be needed to correct discrepancies in the occlusal plane or to provide the tooth with appropriate contours for clasp ing.

It would be foolish to initiate restorative treatment before completion of a diagnostic mounting and design of the necessary removable partial denture(s). As previously noted, inadequate tooth contours may necessitate the placement of complete-coverage restorations (ie, crowns). If an otherwise satisfactory amalgam restoration is present in an area that is to receive a rest seat, the amalgam restoration must be evaluated to determine whether it is strong enough to withstand the forces it will receive. The outline form of the restoration should be examined to determine whether the entire rest seat will be in amalgam or whether part of the rest seat will contact sound tooth structure. The occlusion should be examined to determine how deep the rest seat must be. Radiographs should be examined to determine the thickness of the amalgam restoration in the area to be prepared. After all these factors have been considered, the most appropriate decision may be to replace the amalgam with a complete-coverage restoration. (Fig. 2)

![Fig. 2](image)

The existing restoration should be examined to modified or replaced with a complete-coverage restoration to fulfillment the partial denture requirement.

Satisfactory amalgam or tooth-colored restorations on the facial surfaces of prospective abutment teeth also must be carefully evaluated. Excessive wear of such restorations may occur if a retentive clasp tip will contact a restoration or cross its margins while moving in and out of the undercut. This wear can result in failure of the restorations or diminished retention of the removable partial denture.

Care must be taken in the placement of margins of cast restorations as well. Frequent movement of a retentive clasp tip may contribute to premature failure of a cast restoration.

Not every tooth that can be saved through restorative procedures should be retained. The more prudent treatment may be removal of the tooth. This is particularly true when retention of a compromised tooth would complicate the design of a prosthesis, or if it would have limited value in the long-term treatment prognosis. Hence, preventive dentistry for a partially edentulous patient does not mean the retention of every retainable tooth.

**Evaluation of pulpal tissues**

If warranted, pulp testing should be used to assess the vitality of remaining teeth. It can be inconvenient and expensive for the patient, as well as embarrassing for the
dentist, if a pulpal problem is overlooked, and it is discovered that an abutment must be endodontically treated or removed at a later date.

Teeth that have been endodontically treated must be carefully evaluated before selection as abutments. Endodontically treated teeth tend to become more brittle with time, and abutments for removable partial dentures are subjected to considerable stresses. Nevertheless, the selection of endodontically treated teeth as abutments is not contraindicated. If an endodontically treated tooth has a relatively large access opening or an extensive intracoronal restoration, a dowel-and-core restoration and a complete-coverage crown may be indicated to minimize the likelihood of coronal fracture.

**Evaluation of sensitivity to percussion**

All remaining teeth should be tested for sensitivity to percussion. Particular attention should be focused on the prospective abutment teeth. The following conditions can contribute to irritation of the periodontal ligament fibers, making a tooth sensitive to percussion:

1. Tooth movement caused by an unstable occlusion or ill-fitting prosthesis
2. A tooth or restoration in traumatic occlusion
3. Periapical or pulpal abscesses
4. Acute pulpitis
5. Gingivitis or periodontitis
6. Cracked tooth syndrome

The exact cause must be determined through the evaluation of other diagnostic data. A removable partial denture should not be constructed until the cause of the discomfort is discovered and the sensitivity is eliminated. The use of a percussion-sensitive tooth as an abutment may result in early failure of the associated prosthesis.

**Evaluation of tooth mobility**

Teeth with detectable mobility should be evaluated to determine the causes of such movement. A mobile tooth used as an abutment will have a poor prognosis unless the mobility is markedly decreased. Tooth mobility may be caused by one or more of the following factors:

1. Trauma from occlusion
2. Inflammatory changes in the periodontal ligament
3. Loss of osseous support

In most instances, tooth mobility that results from occlusal trauma usually is reversible. To minimize mobility, the source of occlusal trauma must be identified and corrected. Properly mounted diagnostic casts are useful in the identification of occlusal disharmonies. Correction of occlusal disharmonies may be accomplished by occlusal equilibration or by the placement of one or more restorations.

Tooth mobility caused by inflammatory changes in the periodontal ligament may be reversed if the inflammation is eliminated.
Tooth mobility caused by a loss of osseous support is not reversible in most instances. A tooth with a crown-root ratio greater than 1:1 is not suitable as an abutment for a removable partial denture (Fig 3). In these instances, adjacent teeth should be evaluated. If an adjacent tooth is capable of serving as a strong abutment, the practitioner may choose to remove the periodontally weakened tooth. Splinting a weak tooth to a strong tooth must be approached cautiously because splinting frequently weakens the stronger tooth rather than strengthening the weak one.

Fig 3. A crown-root ratio greater than 1:1 is unfavorable.

Fig 4 (a) This tooth exhibits a crown-root ratio greater than 1:1. (b) By performing endodontic therapy and shortening the clinical crown of the tooth, a more favorable crown-root ratio may be achieved.

In some situations, the root of a periodontally weakened tooth may be retained as an overdenture abutment. Overdenture abutments can provide significant support for a removable prosthesis. Clinically, an overdenture abutment should be endodontically treated. In turn, the clinical crown should be reduced and the exposed portion of the root should be gently rounded. The peripheries of the overdenture abutment should be located at the gingival level, while the tallest portion of the "dome" should extend 2 to 3 mm above the gingival margins. This procedure greatly improves the crown-root ratio of a periodontally compromised tooth and often eliminates tooth mobility (Fig 4). Hence, this concept of treatment should always be considered when the removal of one or more teeth will result in a large edentulous area. A single overdenture abutment is extremely valuable in providing support, particularly in large anterior edentulous areas and distal extension applications.

**Indications for splinting**

Splinting may be necessary when the remaining teeth display compromised periodontal support or short, tapered roots. By splinting two or more teeth, it may be possible to provide improved support for a removable prosthesis (Fig 5). It is imperative that such restorations be constructed in harmony with the patient's occlusion, temporomandibular joint, and musculature. Furthermore, the removable partial denture must be designed and constructed to place minimal stresses on the splinted teeth.
Splinting with a fixed partial denture is indicated when the first premolar and the molars have been lost and the second premolar is to serve as an abutment. A lone-standing second premolar is likely to be damaged by the forces applied to a distal extension removable partial denture. Placement of a fixed partial denture will restore the continuity of the arch and create a more favorable prognosis for the tooth and the removable partial denture (Fig 6).

Evaluation of periodontium

Periodontal disease is one of the primary factors in tooth loss. Therefore, a large percentage of partially edentulous patients show evidence of gingivitis and periodontal disease. A removable partial denture placed in the presence of active periodontal disease may contribute to the rapid progression of the disease and loss of the remaining teeth. If removable partial denture therapy is to be successful, disease processes must be controlled.

The periodontium of partially edentulous patients must be evaluated if any type of prosthodontic treatment is being considered. Evaluation of the periodontium must be based upon thorough clinical and radiographic examinations. The clinical examination must disclose the presence of periodontal pockets, inflammation, infection, furcation involvement(s), and the absence of sufficient attached gingiva.(Fig.7)

Examination findings that indicate possible need for periodontal treatment include the following: (Fig. 7)

1. Pocket depth in excess of 3 mm
2. Furcation involvement
3. Deviations from normal color and contour in gingivae, which indicate gingivitis
4. Marginal exudate upon probing or application of digital pressure
5. Proposed abutment teeth exhibiting less than 2 mm of attached gingiva
6. An inadequate band of attached gingiva associated with the remaining teeth
Fig. 7 The clinical examination must disclose the presence of periodontal pockets, inflammation, infection, furcation involvement(s), and the absence of sufficient attached gingiva.

From a prosthodontic standpoint, the objective of periodontal treatment of abutment teeth should be restoration of the periodontium to optimum health and creation of contours that will allow the patient to preserve this state of health. Periodontal therapy that falls short of this objective may compromise the prognosis of prosthodontic treatment.

**Evaluation of oral mucosa**

*Pathologic changes*

Any ulceration, swelling, or color change that might indicate a malignant or premalignant lesion should be recognized and properly evaluated through biopsy or referral.

Erythematous (red) lesions seem to be much more indicative of oral cancer than are white lesions. Any persistent red lesion of the floor of the mouth, ventrolateral tongue, or soft palate complex should be considered carcinoma in situ or invasive carcinoma unless these entities are ruled out by biopsy.

Partially edentulous patients usually fall within the cancer-prone age group (40 to 60 years). Therefore, careful examination of the oral soft tissues is essential for these patients. Smokers and drinkers are particularly vulnerable to cancerous and precancerous lesions.

*Tissue reactions related to prosthesis utilization*

Tissue reactions related to the use of dental prostheses should be recognized, evaluated, and treated as necessary. The most common tissue reactions related to prosthesis utilization are palatal papillary hyperplasia, denture epulis formation, denture stomatitis, and soft tissue displacement.

- **Papillary hyperplasia**

Papillary hyperplasia is a soft tissue condition that commonly occurs on the anterior hard palate but may affect the remainder of the hard palate and the residual ridges. The condition is caused by an inflammatory response in the submucosa. Clinically,
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Papillary hyperplasia presents as a collection of small, rounded, soft tissue growths (Fig 8). Individual growths are separated by distinct crevices.

![Papillary hyperplasia](image)

**Fig 8.** Papillary hyperplasia (arrows) presents as a collection of small, rounded, soft tissue growths.

Food debris, fungi, and bacteria often collect in these crevices and may give rise to secondary infection. Palatal papillary hyperplasia usually is associated with poorly fitting prostheses that have been worn for prolonged periods. Inadequate oral hygiene also may contribute to development of this condition.

Tissue conditioning and tissue rest may help resolve some of the edema and inflammation, but only surgical removal will eliminate the hyperplastic papillae. As a result, the affected regions must be evaluated to determine whether they will present oral hygiene problems. If the patient will not be able to properly clean the affected tissues, the hyperplastic tissues should be removed.

- **Epulis fissuratum**

Epulis fissuratum is a tumor like hyperplastic growth caused by an ill-fitting or overextended denture base (Fig 9). In some instances, it may present as a single fold of tissue adjacent to the border of a denture base. In others, it may appear as a double fold of tissue that projects along the internal and external surfaces of a denture base. The sulcus between the folds may be ulcerated.

In its early stages, an epulis is a soft, flabby growth of tissue that produces moderate discomfort. If left untreated, it assumes a harder, more fibrosed character.

In the past, such lesions were surgically excised. Unfortunately, surgical excision may produce scar tissue in the depth of the vestibule. Scarring may limit border extension and adversely affect denture base adaptation. These factors may adversely affect the stability of a removable prosthesis.
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Fig 9. Epulis fissuratum (arrows) is a hyperplastic growth caused by an ill-fitting or overextended denture base.

If an epulis has developed at a denture border, its consistency should be determined. A relatively soft epulis may resolve if the source of irritation is removed. Hence, the offending border should be adjusted until it no longer contacts the lesion. The more fibrosed the epulis, the longer the time required for healing. Even a badly fibrosed epulis will undergo some degree of healing, thereby decreasing the size of the surgical site if excision becomes necessary.

- **Denture stomatitis**

Denture stomatitis is characterized by generalized erythema that affects the soft tissues covered by a prosthesis (Fig 10). It may occur under metal or acrylic resin denture bases and usually is seen in the maxilla. Frequently the oral mucosa is swollen and smooth. While patients may report burning or itching, they rarely complain of pain.

Fig 10. Denture stomatitis is characterized by erythema. The erythematous tissues are located under the denture base of a removable prosthesis.

Research indicates that denture stomatitis is an endogenous infectious disease that affects the tissues and causes the associated lesions. Generally, patients with denture stomatitis display elevated levels of Candida albicans. However, treatment with antifungal medications alone will not cause resolution of denture stomatitis.

Trauma from occlusion, poor fit of the prosthesis, poor oral hygiene, and continuous wear of the prosthesis may contribute to this condition. Therefore, tissue rest and tissue conditioning procedures have been effective in treating denture stomatitis.
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- **Soft tissue displacement**

Displacement of the soft tissues underlying ill-fitting or poorly designed removable partial dentures occurs frequently. Some tissue displacement is usually present in the beaded areas of even a well-fitting prosthesis. Therefore, soft tissues must be allowed to return to normal contours through tissue rest before impressions for master casts are made.

**Evaluation of hard tissue abnormalities**

The presence of a torus, exostosis, or bony undercut can severely compromise the treatment of a partially edentulous patient. All areas to be covered by the prosthesis should be palpated to reveal bony protuberances that could interfere with the placement and removal of the prosthesis, as well as with the comfort of the patient. The diagnostic cast should be examined at the selected path of insertion to reveal potential hard tissue problems.

**Torus palatinus**

Torus palatinus is a benign, slowly growing protuberance of the palatine processes of the maxilla (Fig 10). It occasionally involves the horizontal plates of the palatine bones. Removal of a torus palatinus is not necessary unless it is so large that it interferes with the design and construction of the prosthesis. In many instances, a major connector can be selected and designed to circumvent the torus.

Fig. 10 Torus palatinus is a bony overgrowth arising from the midline of the hard palate.

**Torus mandibularis**

The torus mandibularis is an exostosis on the lingual surface of the body of the mandible (Fig 11). In most instances, such tori occur bilaterally. The mucoperiosteum covering such tori is very thin and easily traumatized.

Mandibular tori should be removed if the patient is to wear a removable partial denture with any degree of comfort. Severe compromises have to be made in the design, rigidity, and placement of the major connector if mandibular tori are not removed. Patient satisfaction with a removable partial denture constructed in the presence of a mandibular torus is rare.
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Fig. 11 Mandibular tori are exostoses on the lingual surface of the mandible. In most instances, mandibular tori occur bilaterally.

Exostoses and undercuts

Exostoses and undercuts that prevent the proper extension of the denture borders should be evaluated and surgically corrected, if necessary (Fig 12). The soft tissues covering exostoses are usually thin. Because pressure from the placement and wear of a removable partial denture can cause the patient considerable discomfort, exostoses should be removed.

Fig. 12 An exostosis (arrows) is a bony overgrowth that may occur on any osseous surface. In this instance, the exostosis is located on the lateral aspect of the maxillary tuberosity.

The maxillary tuberosities, the distolingual areas in the mandibular arch, and recent extraction sites are the most common undercut areas. The effect of some undercut areas may be minimized by a change in the path of insertion of a proposed removable partial denture. Only those undercuts that would seriously compromise the prognosis should be surgically corrected. This decision should be based on whether the denture base can be effectively relieved to accommodate the undercut areas.

Surgical correction of undercuts should be accomplished if relieving the denture base or reducing the length of the denture border would:

1) significantly reduce support and stability of the prosthesis;
2) create a bothersome food impaction area; or
3) cause a denture border to be so far away from the underlying tissue that it may affect function, compromise esthetics, or cause discomfort for the patient.
Evaluation of soft tissue abnormalities

Various soft tissue conditions can present problems in the design and construction of a removable partial denture. Labial and lingual frena, as well as unsupported and hypermobile gingiva should be evaluated to determine whether surgical correction will improve the prognosis.

- Labial frenum

The maxillary labial frenum occasionally presents problems when anterior teeth are replaced with a removable partial denture. If the frenum is attached near the crest of the ridge or if it is hypertrophic, the notch that must be placed in the denture base to accommodate the frenum may be unsightly. A patient with a short or highly mobile upper lip is most likely to need a frenectomy to correct the condition.

- Unsupported and hypermobile gingiva

Unsupported and hypermobile gingiva occurs more frequently in completely edentulous patients. Nevertheless, atrophy of the residual ridge may occur in partially edentulous patients. In these instances, the gingiva loses its bony support and becomes freely mobile. Adequate support is not provided for the denture base. When this occurs, the area should be evaluated to determine whether ridge augmentation procedures should be considered.

Evaluation of quantity and quality of saliva

If the mouth is dry, the patient will probably be uncomfortable wearing a removable partial denture. Denture bases will drag across the tissues during placement and removal of the prosthesis. This may result in irritation or ulceration of the soft tissues and significant discomfort for the patient. Medications, radiation, advanced age, systemic disturbances, and anxiety can markedly reduce salivary output. Hence, a thorough medical history is essential.

Thick, mucinous saliva and excessive quantities of saliva present problems during impression procedures.

Evaluation of space for mandibular major connector

A properly constructed lingual bar major connector must be a minimum of 5 mm in height. The superior margin of the connector should be located 3 mm from the free gingival margins of the mandibular teeth to avoid damage to the gingival tissues. The inferior border of the connector should be positioned at or slightly above the active floor of the mouth to prevent interference with functional movements and to minimize the accumulation of food under the major connector. Therefore, a minimum of 8 mm of vertical space must be available if a lingual bar major connector is planned. A lingual plate major connector should be used if less than 8 mm is available. (Fig 13)

It is not possible to accurately determine the position of the active floor of the mouth on a cast because most casts are overextended in this area. The selection of the major connector should be based on clinical examination and not on the casts.
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connector and the determination of the location of its inferior border can be accomplished most effectively when the distance from the free gingival margins to the active floor of the mouth is measured in the mouth.

Fig.13 A minimum of 8 mm of vertical space between the free gingival margin and the active floor of the mouth must be available if a lingual bar major connector is planned.

Available space can be measured with a calibrated instrument. A periodontal probe with millimeter markings works well. The patient is instructed to raise the tongue toward the palate. This raises the floor of the mouth to its highest level. The tip of the probe is placed to contact the floor of the mouth lightly. The millimeter depth is read at the point where the probe contacts the gingival margin. Readings are made and recorded at several positions. The probe is then used to transfer the measurements to the diagnostic cast. The points are connected by drawing a line that will indicate the position of the active floor of the mouth.

**Evaluation of radiographic survey**

An evaluation of the complete radiographic survey is made with special attention focused on prospective abutments and residual ridge areas. All radiolucent and radiopaque areas that vary from normal ranges are carefully examined to determine whether a pathologic condition is present.

The radiographic findings are correlated with the clinical examination to reveal the presence and extent of caries and the relation of the carious lesion to the dental pulp. Existing restorations are evaluated to determine their adequacy.

Root fragments and other foreign bodies are evaluated to determine whether their removal is indicated.

Not all retained roots have to be removed. If the roots are deeply embedded and exhibit no evidence of pathologic changes, it is frequently advisable to keep them under observation rather than to remove them. Removing deeply embedded root tips may necessitate the removal of bone and result in a somewhat compromised residual ridge. Root tips not completely enclosed in bone and any retained root or foreign body that shows radiographic evidence of pathologic changes should be removed.

Third molars are evaluated to determine whether they should be retained or removed. Consideration should be given to retaining the third molar as a posterior abutment if its size, shape, and position appear favorable. The greater comfort and stability provided by a tooth-borne removable partial denture (versus a distal extension
removable partial denture) make the retention of a possible posterior abutment extremely important. It can be hazardous to retain an unerupted third molar if it is to be covered by prosthesis. Subsequent eruption can contribute to considerable occlusal and tissue trauma. Therefore, the patient must understand the potential problems and must report the first signs or symptoms of eruption. As an additional measure, frequent clinical and radiographic examinations should be arranged.

Root canal fillings within prospective abutments are evaluated with special emphasis. Root canal fillings should be reaccomplished if the quality or completeness of the fill is questionable. Radiolucent areas on the lateral or apical aspects of the root require careful evaluation. Available radiographs should be examined to determine whether the radiolucency indicates a new pathologic condition or fibrous healing. In most instances, the placement of an extracoronal restoration is indicated on an abutment that has received endodontic treatment, particularly if a large access opening has been made or if the tooth has extensive intracoronal restorations.

**Radiographic evaluation of prospective abutment teeth**

All prospective abutment teeth must be critically evaluated as described in the following discussion.

*Root length, size and form*

Teeth with large or long roots are more favorable abutments because of the greater potential area for periodontal support. However, the relationship between the length of the clinical crown and the amount of root embedded in bone is the most critical factor. The root form of a prospective abutment has a significant influence on its probable effectiveness. Tapered or conical roots are unfavorable because even a small loss of bone height can greatly diminish the attachment area. Multirooted teeth whose roots are divergent or curved generally are stronger abutment teeth than single-rooted teeth or multirooted teeth whose roots are fused.

The proximity of roots also is important. If the roots of adjacent teeth are in close proximity and display little interproximal bone, even moderate irritation or force may be destructive.

*Crown-root ratio*

If the crown-root ratio is greater than 1:1 or if furcation involvement of a multirooted tooth is present, the tooth has a poor prognosis as an abutment. Nevertheless, a tooth with a poor prognosis can still provide support for a prosthesis. Periodontal, endodontic, and restorative treatment can be used to retain one or more roots of a multirooted tooth. Alternatively, endodontic treatment can be used to prepare a tooth with a poor crown-root ratio as an overdenture abutment.

*Lamina dura*

Partial or total absence of the lamina dura may be found in systemic disorders such as hyperparathyroidism and Paget disease. However, changes in the lamina dura are more frequently caused by function. Resorption or loss of lamina dura occurs where
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there is pressure, and apposition occurs where there is tension. A tooth that is in the process of tipping because of loss of an adjacent tooth will show evidence of both resorption and apposition. A thickening of the lamina dura may occur if the tooth is mobile, has occlusal trauma, or is under heavy function. Occlusal trauma can also cause partial or total loss of the lamina dura.

Evidence of changes in the lamina dura should be correlated with findings of the clinical examination and evaluation of the occlusion. Destructive forces or disease processes causing changes in the lamina dura must be corrected, or the abutment will have a poor prognosis.

**Periodontal ligament space**

Changes in the width of the periodontal ligament space must be considered when prospective abutments are evaluated. A widening of the periodontal ligament space with a thickening of the lamina dura usually indicates mobility, occlusal trauma, and heavy function. To evaluate these radiographic findings, it is necessary to correlate them with clinical mobility. If the tooth is mobile, these radiographic signs indicate destructive changes. If the tooth is not mobile, these signs may indicate a favorable response to increased occlusal forces. However, the added stress of serving as an abutment may result in severe damage or failure. Therefore, every effort should be made to eliminate heavy occlusal forces on a prospective abutment.

**Evaluation of mounted diagnostic casts**

Mounted diagnostic casts can provide important information that may be difficult to obtain by intraoral examination alone. Potential problems such as insufficient interarch space, irregularity or malposition of the occlusal plane, extruded or malposed teeth, and unfavorable maxillomandibular relationships are more apparent when using accurately mounted casts because the lips, cheeks, and skull do not permit good visual access to the teeth in the mouth. Mounted diagnostic casts provide improved visual access from all directions and enable the practitioner to make a detailed analysis of the patient's occlusion.

**Interarch distance**

A fairly common finding is lack of sufficient interarch distance for the placement of prosthetic teeth. Frequently the problem is caused by a maxillary tuberosity that is too large. A segment of teeth that has been unopposed for a prolonged period will frequently over-erupt, carrying the alveolar process with it. Subsequent removal of the teeth will produce a situation in which it is impossible to establish an acceptable occlusal plane. Surgical reduction of the tuberosity may be necessary if satisfactory replacement of the missing teeth is to be accomplished. The amount and location of tissues to be removed can be indicated on the diagnostic cast. This provides aids when planning such procedures. The soft tissues overlying each tuberosity are visible on panoramic radiographs and indicate the thickness of coverage in these areas. This helps the practitioner determine whether the surgical procedure can be accomplished by soft tissue correction alone or whether bone removal is also necessary. The majority of tuberosity interferences can be corrected by removal of a wedge of soft
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tissue. Healing is usually complete in 7 to 10 days. The healing period is extended to 2 to 3 weeks when bone removal is necessary.

Maxillary tuberosities also may exhibit unilateral or bilateral mechanical undercuts. These undercuts are carefully evaluated using a dental surveyor. With the cast on the surveying table at the predetermined path of insertion, a determination is made regarding the amount of relief that will be required in the denture if the undercut is not reduced. Moderate to severe tuberosity undercuts usually require surgical correction with bone removal.

**Occlusal plane**

The occlusal plane may be irregular because of extrusion of one or more unopposed teeth. The entire plane may be poorly oriented because of the extrusion of a sizable segment of the dental arch. Both conditions require corrective procedures if an acceptable occlusion is to be developed.

**Irregular occlusal plane**

Several courses of treatment are available for correction of an extruded tooth. The treatment will vary depending on the degree of extrusion and the condition of the tooth.

Enameloplasty can be used to reduce a moderately extruded tooth. Approximately 2 mm of enamel can be removed in many situations. At times, such reduction can correct a noticeable discrepancy in the occlusal plane.

If the extrusion is greater than 2 mm or if the tooth does not lend itself to enameloplasty, the placement of a crown may be indicated. Tooth reduction may be limited by the size of the dental pulp, the length of the clinical crown, or both. If the size of the dental pulp will prevent the required tooth reduction, endodontic therapy should be completed before tooth preparation is undertaken. If clinical crown length is inadequate, crown-lengthening procedures should be completed before tooth preparation is begun.

Severely extruded teeth, such as those contacting the opposing ridge, present greater problems. If the alveolar bone has followed the eruption of the offending tooth, it may be necessary to remove the tooth and recontour the surrounding bone. At times endodontic treatment and drastic reduction of the tooth will enable it to be used as an overdenture abutment. This treatment can provide valuable support for a distal extension base.

In some instances, maxillary premolars and molars may be unopposed on one or both sides of the dental arch. Often this results in extrusion of the unopposed teeth and is accompanied by a dental arch. Often this results in extrusion of the unopposed teeth and is accompanied by a downgrowth of the associated alveolar process. The extruded teeth may approximate or contact the opposing residual ridge, causing obvious space problems and malposition of the occlusal plane.
Diagnosis and Treatment Planning For RPD

Dr. Ashraf Gebreel

One approach to treatment is the removal of the extruded teeth in conjunction with an extensive alveolectomy. However, consideration should be given to corrective (ie, orthognathic) surgical procedures. These procedures are beyond the scope of this text. Therefore, readers are referred to oral and maxillofacial surgery texts for a thorough review of orthognathic surgical procedures and their applications.

Malrelation of jaws

Severe malrelation of the jaws can preclude the restoration of adequate function and esthetics. Several maxillary and mandibular osteotomy procedures are useful in correcting these problems. The practitioner is referred to oral and maxillofacial surgery texts for a thorough review of these procedures.

Tipped or malposed teeth

Posterior teeth tend to drift or tip anteriorly when an edentulous space is created immediately mesial to them. Limited orthodontic procedures for minor tooth movement can be used to upright such teeth and permit an improved prosthodontic result.

Remaining teeth also may be buccally or lingually inclined. In many instances, the orientations of these teeth may be corrected via controlled orthodontic movement. In other instances, removal of one or more malposed teeth may simplify the design of the prosthesis.

Occlusion

Mounted diagnostic casts are commonly used for occlusal assessment. The information obtained during occlusal assessment should be correlated with relevant clinical findings. A common finding is the presence of occlusal interferences.

More than 90% of patients display a noticeable discrepancy between centric relation and maximal intercuspal position. Partially edentulous patients have an even greater probability of deflective occlusal contacts because of the drifting and migration of teeth that usually accompany the loss of one or more posterior teeth. Many patients can adapt to imperfections in the occlusion so that deflective contacts do not become traumatic factors. However, there is a limit to physiologic adaptation to the imperfections or disharmony of occlusion. This limit may be surpassed if additional discrepancies are added to the occlusion or if central nervous system tension increases. The result may be increased muscular response leading to bruxism.

Severe bruxism can injure the teeth, the periodontium, and the temporomandibular joint and may initiate muscle spasm and discomfort. The most common causes of bruxism are (1) occlusal interferences (ie, deflective contacts) between centric relation and maximal intercuspal position and (2) occlusal contacts on the nonworking side of the arch.
Diagnosis and Treatment Planning For RPD

The clinical symptoms of traumatic occlusion often present in the following ways:

1. Excessive wear of the teeth, which may include chipping or fracture of their surfaces
2. A noticeable change in the periodontium, which may result in increased tooth mobility, tooth migration, and discomfort during occlusal contact
3. Involvement of the neuromuscular mechanisms of the temporomandibular joint, which may include muscle spasm, muscle pain, and joint dysfunction

The radiographic signs of traumatic occlusion may include:

1. Widening of the periodontal ligament space with increased or decreased thickness of lamina dura
2. Periapical radiolucency
3. Resorption of alveolar bone
4. Root resorption

Role of occlusal equilibration

Occlusal equilibration is the selective grinding or coronal reshaping of teeth with the intent of producing simultaneous occlusal contacts, minimizing non-axial forces, and/or harmonizing cuspal relations.

Some practitioners believe that all patients should undergo occlusal equilibration to ensure that centric relation and maximal intercuspal position are coincident. However, occlusal equilibration should not be accomplished for every patient with interferences. Many patients exhibit skeletal and neuromuscular characteristics that minimize dental wear regardless of the occlusal relationships of the teeth. If occlusal equilibration is accomplished on these individuals, an "occlusal awareness" can be developed and may contribute to destructive neuromuscular activity. Faulty occlusal equilibration may induce severe trauma from occlusion.

Extensive occlusal equilibration should never be initiated on a patient with acute temporomandibular joint dysfunction. The symptoms and muscle spasm should be eliminated through the use of an occlusal device before occlusal adjustment is initiated.

Occlusal equilibration should be accomplished only for those individuals who have a definite need for such treatment, such as those with symptoms of traumatic occlusion. Nonworking interferences on natural teeth are particularly destructive and should be eliminated.

If an occlusal equilibration is indicated, the equilibration should be accomplished before restorative procedures are initiated. To determine the feasibility and outcome of this process, an equilibration should first be accomplished on accurately mounted diagnostic casts. This trial equilibration can serve as a blueprint for intraoral adjustment, and, therefore, all steps should be recorded. In addition, the diagnostic equilibration may indicate the need for extraction, orthodontic therapy, placement of fixed restorations, or a combination of these procedures.
The decision to treat at centric relation or maximal intercuspal position

The decision whether to construct a prosthesis at centric relation or maximal intercuspal position must be made during the diagnostic phase of treatment. The following clinical situations suggest that prostheses should be constructed at centric relation:

1. Coincidence of centric jaw relation and maximal intercuspal position
2. Absence of posterior tooth contacts
3. Situation in which all posterior tooth contacts are to be restored using fixed restorations
4. Few remaining posterior contacts
5. Existing occlusion that can be made acceptable with minor occlusal equilibration
6. Clinical symptoms of occlusal trauma

In the absence of these indications, a removable partial denture should be constructed at maximal intercuspal position. Special care must be taken in the construction and fitting of the prosthesis to make certain that new interferences are not introduced by a removable partial denture.

Diagnostic waxup

A diagnostic waxup is a valuable diagnostic tool, especially if multiple crowns or fixed partial dentures are planned. Problems involving the position and relationship of the remaining teeth become apparent. In addition, the diagnostic waxup provides a guide for tooth preparation and helps indicate problems that may be encountered in establishing the desired occlusal relationships.

Consultation Requests

Consultation with appropriate medical or dental specialists is often necessary to ensure the safety and suitability of patient treatment. Consultation requests and reports should be clearly written to avoid misunderstandings. Written consultation requests and reports become a permanent part of the patient's record and are available for reference if needed.

The request for medical consultation should include information about the patient's oral condition and should indicate the dental procedures to be used during treatment. Specific questions concerning the need for premedication or supportive medical care may be appropriate.

Consultation requests to dental specialists should indicate whether the patient is being referred for an opinion or for specific treatment. The dentist's evaluation of the present oral condition and the tentative sequence of treatment should also be included. Clear communication and cooperation are essential whenever more than one dentist is responsible for the treatment of the patient.
Development of Treatment Plan

Introduction

The development of an appropriate treatment plan for a partially edentulous patient can be extremely difficult. A great number of factors influence the ultimate success of treatment. An adequate level of oral hygiene is one of the most important factors, and yet it is one of the most elusive.

Decisions must be based on complete evaluation of all diagnostic data. Properly mounted diagnostic casts are essential in the planning of treatment for a partially edentulous patient. Appropriate removable partial denture designs also are essential. The procedures required to treat the patient should then be placed into a logical treatment sequence.

Treatment of a partially edentulous patient can be divided into five phases. While some phases may overlap, the overall treatment plan should reflect these five phases of treatment. Procedures within each phase should be completed on a priority basis depending upon the patient's needs.

PHASE I

1. Collection and evaluation of the diagnostic data, including a diagnostic mounting and design of diagnostic casts
2. Immediate treatment to control pain or infection
3. Biopsy or referral of patient to an appropriate health professional
4. Development of a treatment plan
5. Education and motivation of patient

PHASE II

1. Removal of deep caries and placement of provisional restorations
2. Extirpation of inflamed or necrotic pulp tissues
3. Removal of periodontally hopeless and nonrestorable teeth
4. Periodontal therapy
5. Construction of interim prostheses for function or esthetics
6. Occlusal equilibration
7. Education and motivation of patient

PHASE III

1. Preprosthetic surgical procedures
2. Definitive endodontic procedures
3. Definitive restoration of teeth, including placement of fixed restorations
4. Fixed partial denture construction
5. Education and motivation of patient

PHASE IV

1. Construction and placement of removable partial denture(s)
2. Oral and written instructions regarding the use and care of removable prostheses

PHASE V

1. Postinsertion care
2. Periodic recall
3. Reinforcement of education and motivation of patient