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Overdenture

A graduation project submitted to the College of Dentistry, the University of Baghdad in partial fulfillment of the requirement for a degree Of B.D.S.

By

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بسم الله الرحمن الرحيم

نَرفَعُ دَرَجَاتٍ مَن نَّشَآءُ

وَفَوقَ كُلِّ ذِى عِلمٍ

عَلِيمٌ

Supervisor certification

This is to certify that the organization and preparation of this project have been made by the graduate student **Aya Ibrahim Nassar** under my supervision at the College of Dentistry/University of Baghdad in partial fulfillment of the requirement for the degree of B.D.S.

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Dedication

I proudly dedicate my graduation project and the summary of my study to the one whom God has crowned with dignity, who taught me without exhaustion, for the one I proudly bear his name (my father).

To the more precious than my heart and my eye, to whom her supplication was the secret of my success, may God reward her on my behalf with the best reward (my mother).

Without their continuous support, I would not complete my studies without them (brothers and sisters).

To the one who believed in me and believed in my abilities and was able to support me with love and without waiting for anything in return, who gave me strength despite his weakness and illness... To the one who waited for my graduation more than me, but fate had another opinion (May he rest in peace).

And lastly,

To the companion of the path, to those who carry with me the hours of hardship and suffering, and share with me the moments of joy and tiredness together, I will always appreciate all they have done.

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ERA	**Extra-Radicular Attachment**
G.P.T	Glossary of Prosthodontic

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Introduction

The state of tooth loss is a common problem due to various causes such as periodontitis, systemic diseases, oral pathology, and dental caries. Awareness about oral hygiene and care helps improve the dentate status of the patient. Preservation of remaining oral structures is also important in prosthodontics rehabilitation. Overdentures play a vital role in the preservation of the remaining tooth, tooth root, and alveolar bone. The main benefits of overdenture are retention and stability of prosthesis, which gives psychological benefits ***(Deepak Nallaswamy Veeraiyan, 2017).***

Overdentures are used as a treatment option in dentistry for more than 100 years. In 1856 Ledger constructed plates that covered the teeth and he referred the teeth to as fangs. Evans described the use of roots to preserve restorations in 1888, in 1896 Essig described the use of telescopic coping over intentional devitalization of roots. Dolder bars for overdentures were introduced in 1961. In 1969, Morrow, et al. narrated the simplified techniques of overdentures. In 1980, after the introduction of the phenomenon called osseointegration by Branemark et al, implant overdentures become an option ***(Deepak Nallaswamy Veeraiyan, 2017).***

Most changes occur in the first three months of extraction, a 50% reduction in the buccolingual width of bone has been estimated, in addition to a decrease in bone height at 12 months after extraction ***(Cardaropoli et al., 2015).***

The functional forces in overdentures are shared between the teeth and the bone, there appears to be a physiologic stimulus to maintain the bone height. The periodontal ligament of the abutment teeth is important in both, retention and sensory innervation. The sensory input from the periodontal receptors helps

in increased coordination of muscular contraction, and thereby greater coordination of mandibular movement ***(de Freitas Borges et al., 2010).***

Also, patients showed improvement in their chewing efficiency ،increases maximum bite force, denture stability, food avoidance, and oral health-related. Quality of life improves satisfaction in comparison to conventional complete denture wearers ***(Sumit Sanghai and Parama Chatterjee, 2009).***

Tooth-supported overdentures are indicated when only a few teeth remain and are unfavorably distributed for supporting clasp-retained RPDs when abutment teeth have little remaining tooth structure, when the crown-to-root ratio is disadvantageous for the long-term survival of abutment teeth, or when the patient does not tolerate clasp-retained RPDs for aesthetic reasons. In these situations, the remaining teeth may be devitalized, shortened, and may provide retentive precision attachments to improve the retention and stability of the denture ***(Berger et al., 2020).***

With advances in osseointegrated implants and the success of fixed dental prostheses has come a change in treatment options for patients who desire removable prostheses but who have completely or partially edentulous ridges. Treatment options include complete or partial dentures retained by single or multiple endosseous implants, and a variety of attachments, such as ball attachments, Locator abutments, bar attachments, and even magnets ***(Vahidi and Pinto-Sinai, 2015).***

Aims of the review

- Evaluate the evidence suggests that restoration of the edentulous patients with a conventional denture is no longer the most appropriate first-choice prosthodontic treatment.
- Examine the evidence that an overdenture should become the first choice of treatment for edentulous patients.
- Explain if implants can be used in conjunction with attachments to enhance the retention and stability of overdentures.
- Discuss the potential effect of the different attachments used routinely in tooth and implant-retained overdentures.

Chapter one

Review of literature

1.1 Overdentures

Overdenture is any removable dental prosthesis that covers and rests on one or more remaining natural teeth, the roots of natural teeth, and/or dental implants. It is one of the most practical measures used in preventive dentistry; it is also called overlay denture, overlay prosthesis ***(Taylor, 2017)***.

1.1.1 Indications of overdentures

- Few remaining teeth are unsuitable for fixed or removable partial dentures.
- Remaining teeth present with unhealthy periodontal conditions.
- Patients with class II or class III Angle's classification - Esthetics & masticatory function improved.
- Patients presenting abnormal jaw size large maxillary or mandibular bone defects.
- The construction of over-denture is an alternative line of treatment to single dentures opposing a few natural teeth.
- Patients presenting congenitally missing teeth and congenital defects such as cleft palate, microdontia, amelogenesis or dentinogenesis imperfecta, or partial anodontia.
- Overdentures can be useful for patients with a severe ridge defect or bone resorption.
- Patients who have unfavorable tongue positions and muscle attachment for a conventional removable prosthesis.

- If the patient has a superficially placed mental nerve, then the preferential choice of treatment may be to leave certain teeth in place to prevent damage to the nerve and prescribe an overdenture for any aesthetic needs.
- An overdenture can be prescribed for a patient who has just had a root canal treatment completed to protect the coronal seal of the tooth if they are waiting to have fixed prosthodontics carried out on the tooth. ***(Bansal, Aras and Chitre, 2013).***

1.1.2 Contraindications of Overdenture:

- Uncooperative and under-motivated patients who insist on the removal of their remaining teeth or are considered unable to maintain oral hygiene and regular office procedures.
- Inter-arch space is inadequate to accept the denture and the abutments.
- Mentally and \or physically handicapped.
- Cost and time considerations.
- When other treatment modalities promise superior results.
- Lack of patient acceptance.
- Abutments exhibiting mobility, which exceeds grade 3.
- Economically unsound or patients who cannot afford treatment for reasons of financial constraints unaffordable patients ***(Bohle et al., 2008).***

1.1.3 Advantages of overdentures:

- Preserving the remaining residual ridge by decreasing the rate of bone resorption.
- Preservation of the abutments as part of the residual ridge to gain support.
- Preserving the response of proprioceptive exists in the periodontal membrane of the abutment tooth.
- The modified teeth provide a definite vertical stop for the denture base.

- ❖ Horizontal and torque forces are minimized.
- ❖ Stability and support are increased.
- ❖ Patient acceptance and Psychological Benefits.
- ❖ A Simple Approach to the Problem Patient.
- ❖ fewer post insertion problems
- ❖ Convertibility& effective management.
- ❖ Periodontal Maintenance. (by distributing the applied forces over the remaining teeth) physiological stimulation.
- ❖ Provide retention through the attachments.
- ❖ A roofless denture or open palate is possible ***(Shafie, 2014).***

1.1.4 Disadvantages of overdentures:

- ❖ The susceptibility of the overlaid teeth to caries is high.
- ❖ The periodontal disease of the retained teeth.
- ❖ Bony undercuts of the alveolar ridge are often found adjacent to retained teeth over.
- ❖ Contoured (bulky denture) or under contoured flanges especially in canine eminence.
- ❖ Encroachment interocclusal distance beyond the denture space Overdenture construction is expensive with frequent recall check-ups of the patient than a conventional removable complete denture ***(Samra et al., 2015).***

1.1.5 The important goals of overdenture:

The overdenture accomplishes three rather obvious, but tremendously important goals:

- The first goal it maintains teeth as part of the residual ridge. This gives the patient a denture that has far more support than any Conventional appliance.

Instead of the soft, movable mucous membrane، the denture sits on teeth "pilings," enabling the denture to withstand a much greater occlusal load without movement. "Retentive devices may be incorporated into the denture-tooth contact, resulting in improved retention as well as support.

- The second goal achieved by the overdenture is a decrease in the rate of resorption. Alveolar bone exists as a support for teeth. If the teeth are removed, then the alveolar process begins a rate of resorption consistent with the length of time the teeth have been missing.
- The third goal achieved by the overdenture is an increase in the patient"s manipulative skills in handling the denture. With the preservation of the teeth for an overdenture, there is also the preservation of the periodontal membrane that surrounds these teeth .This preserves the proprioceptive impulses supplied by the periodontal membrane; thus a very important part of the myofascial nervous complex is retained when teeth are maintained ***(Winkler, 2009).***

1.2 Overdenture Classification

Overdentures can be classified into:

1-Tooth supported.

2-Implant supported ***(Krennmair et al., 2016).***

1.2.1 Tooth-supported overdenture:

A complete or partial removable denture supported by a tooth or retained roots that are intended to provide improved support, stability, and tactile and proprioceptive sensation and to reduce ridge resorption. The tooth-supported overdenture is also called overlay denture, telescopes denture and biological denture are among the many terms used to define the tooth-supported complete denture. The concept of conventional tooth-retained overdentures is a more

simple and cost-effective treatment than implant overdentures. When few firm teeth are present in an otherwise compromised dentition, they can be retained and used as abutments for overdenture fabrication. This helps improve the retention and stability of the final prosthesis significantly ***(Krennmair et al., 2016).***

1.2.1.1 Advantages of tooth-supported overdenture

1. Effects on the edentulous ridge:

Preservation of the alveolar bone & the original form of the residual arch was better when overdentures were used. When the teeth are retained, the alveolar bone integrity is maintained as it supports the abutment teeth، resulting in a decrease in the rate of bone resorption. However, when the teeth are removed, the alveolar bone resorption process begins. For example، retention of mandibular canines for overdentures helped preserve the remaining edentulous ridge with an average of 0.6 mm of ridge reduction in the anterior part of the mandible compared to cases of patients with complete dentures who lost an average of 5mm of the bone.

2-Improved stability and retention of the denture:

Overdentures provide better denture support & stability due to the preservation of residual ridge contours near the abutment teeth. The vertical walls of the remaining root provide some additional stabilization for the overlying prosthesis. The greater the vertical space occupied by the root preparation, the greater the stabilization provided. Moreover, overdentures provide better denture retention & greater chewing efficiency, especially when retentive attachments are used in a mandibular prosthesis.

3-Tactile discrimination:

Tactile discrimination is the ability to differentiate information received through the sense of touch. With the preservation of the teeth, there is the preservation of the periodontal membrane and this, in turn, preserves the proprioceptive impulses. The extraction of teeth results in the loss of mechanoreceptors from associated periodontal ligaments which are responsible for the proper masticatory function and accurate jaw movements.

4-Psychological benefits to the patient:

The loss of remaining teeth can be a disturbing and emotional experience for many patients as loss of teeth is associated with aging. In addition, upper overdenture can be constructed with the reduced extension of the denture base on the maxilla as the palate needs only to be partially covered when retentive elements are utilized, which is important for the patient psychologically.

5-Fast and inexpensive mode of treatment:

Especially for patients with congenital defects (cleft palate, partial anodontia, microdontia, amelogenesis imperfecta)

6-Convertibility:

If any problem occurs with the existing overdenture abutments, the teeth can be extracted, and the overdenture can be converted to a conventional complete denture ***(Slot et al., 2012).***

1.2.1.2 Selection of abutments

1. **Periodontal and mobility status:** teeth with a significant vertical bone loss and accompanied by grade 2 or 3 mobility, are not suitable abutments. While periodontally compromised teeth but with a good treatment prognosis are probably regarded as suitable abutments even

when horizontal bone loss is present. Slight tooth mobility is not a contraindication because a favorable change in the crown/root ratio after teeth preparation may improve this sign. A circumferential band of attached gingival, although a narrow one, is popularly regarded as a mandatory requirement for abutment selection ***(Resnik, 2020).***

2. **Abutment location:** because the anterior alveolar ridge appears to be most Susceptible to time-dependent occlusal stresses, cuspids and/or bicuspids are regarded as the best overdenture abutments. Clinical experience supports the recommendation of at least one tooth per quadrant. In addition, retained roots or abutment teeth should preferably not be adjacent ones; this will minimize the risk of plaque accumulation and compromising soft tissue health ***(Resnik, 2020).***

3. The teeth should have enough coronal substance to maintain the integrity of abutments ***(Resnik, 2020).***

1.2.1.3 Classification of tooth-supported overdenture

The tooth-supported overdenture is classified in several manners based on:

1.2.1.3.1 The method of abutment preparation:

- Non-coping abutments root overdenture.
- Abutments with copings (telescopic overdenture).
- And Abutments with attachments (attachment overdenture).

1- Non-coping abutment:

The crown of the abutment is reduced to a height of 2–3 mm, is treated endodontically and the entrance (occlusal section) is filled with silver amalgam, glass ionomers, or composite restorations. The occlusal surface should be contoured to a convex or dome shape and is highly polished **(Fig1-1)** ***(Trakas et al., 2006).***

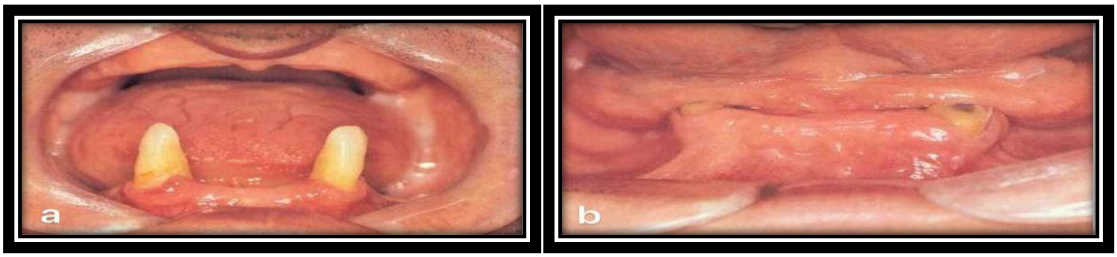

Figure (1-1): Classic presentation of a case suitable for overdentures (a), Reduction of teeth following root canal therapy (b) ***(van Kampen et al., 2003).***

2 -Metal copings:

There are several types of metal copings abutment preparation:

A. **<u>The thimble-shaped copings(long):</u>** can be placed on vital abutments. It is required to be prepared with shoulders and the normal flattened of the occlusal portion, it should be prepared in a round or parabolic form. To direct loads of occlusion along the long axis of the abutments teeth ***(Samantaray R et al., 2020)***. They are 5–8 mm in height and need considerable space. The retention obtained will vary inversely with the taper of the coping. The abutment teeth require greater osseous support and may not need to be endodontically treated **(Figure 1-2)** ***(Trakas et al., 2006)..***

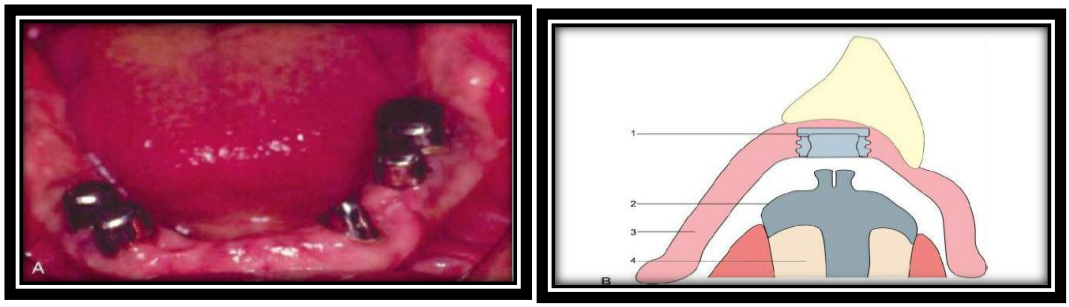

Figure (1-2): (A) Thimble-shaped coping. (B) Extraradicular attachment: (1) Female component attached to denture, (2) male component, (3) denture, (4) abutment tooth ***(Trakas et al., 2006).***

B. **<u>In the dome-shaped coping(short)</u>:** the abutment tooth is endodontically treated and prepared as dome-shaped, extend only 1 or 2 mm above the crest of the ridge to produce a significant improvement in crown root ratio. The contribution of retained roots in retention is negligible but they are used for support against vertical loads. Where employing the dome-shaped copings with a short dowel of 4-5 mm length will be adequate to allow sufficient denture base thickness over the occlusal section, not less than 1.5 mm. The major advantage of a cast coping is that it provides the possibility to solder a precision attachment on top of the coping, leading to additional retention **(Figure 1-3)** ***(Trakas et al., 2006).***

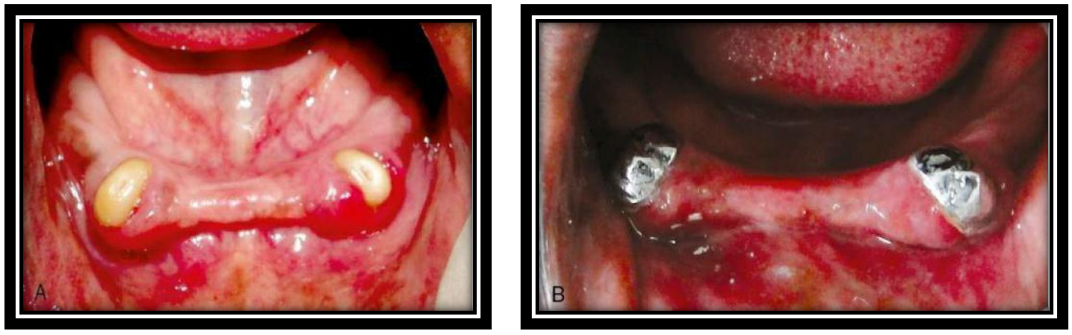

Figure (1-3): (A) The abutment teeth are endodontically treated and reduced in height. (B)Dome-shaped cast metal copings 2–3 mm in height with a chamfer finish line and a post are fabricated and cemented ***(Trakas et al., 2006).***

C. Abutment with telescopic crown:

Refers to the type of prosthesis that includes double crowns as retainers or attachments. These retainers consist of 2 crowns; a primary or inner crown that is cemented to the abutment, and a secondary or outer crown that is attached to the denture **(Fig.1-4)** ***(da Silva et al., 2010).***

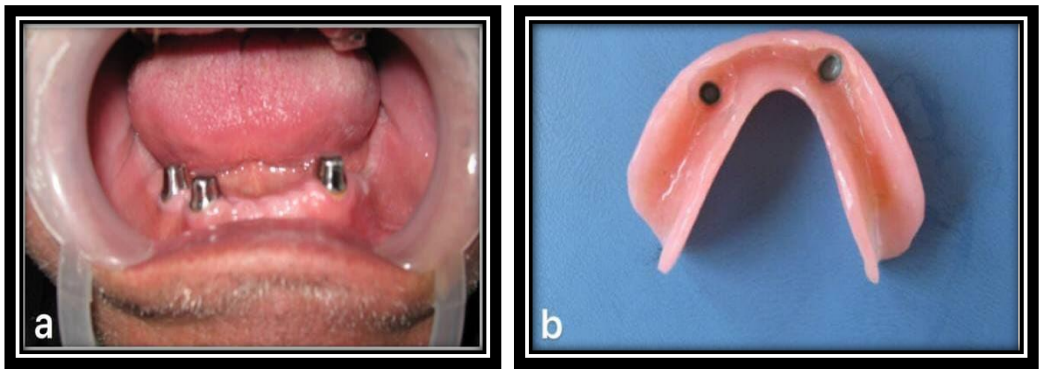

Figure (1-4): (a) Inner telescopic crowns. (b) Outer telescopic crowns are attached to the denture base ***(da Silva et al., 2010).***

3- Abutment with attachment:

A retentive attachment for an overdenture consists of two separable parts a male part and a female part. In the majority of these so-called concealed attachments, the male part is fixed to the abutment tooth as a primary element، while the female part is embedded in the denture base as the secondary element. Most concealed attachments are prefabricated. They are less expensive than attachments that are custom fabricated by the dental technician ***(DeFranco, 1994)***.

1.2.1.3.2 On the type of the overdenture:

1. **Immediate overdenture:** An immediate overdenture is constructed for insertion immediately after the removal of some natural teeth. The remaining natural teeth are treated and the overdenture is inserted as an

immediate replacement. An immediate overdenture is easy to use and has no specialized castings. So it can be used as an interim prosthesis that allows the dentist, the opportunity to evaluate the response of the abutments and supporting tissues to an overdenture and to observe the oral hygiene ***(Stoker and Wismeijer, 2009)***.

2. **Transitional or intermediate over denture**: consists of a modification of partial denture to replace further lost teeth or to cover the roots of overdenture abutments once the teeth have been cut down ***(Alqutaibi and Kaddah, 2016).***
3. **Definitive overdenture**

Constructed at least 6 months following extraction of the teeth and preparation of the abutments. They should be planned to provide a surface for several years ***(Preiskel, 1996).***

1.2.1.3.3 overdenture can be distinguished by their design:

1) completely or partially open design :

Overdentures that do not cover the periodontium of the retained abutments are defined as dentures with a completely or partially open design. If more than three abutments are available, the open design has been recommended. There are many causes for this recommendation: over contouring in the regions of the retained abutments can be avoided, reducing biofilm formation, and, in that way ensuring normal lip, cheek, and tongue function. It has been demonstrated that the open design is considered for enhancing abutment teeth survival **Figure(1-5)** ***(Zarb and Bolender, 2004)***.

Figure (1-5) Open-faced maxillary overdenture. ***(Zarb and Bolender, 2004).***

2) Closed design:

An overdenture with a closed design looks like a complete denture and hence covers the abutment teeth and respective periodontium with a continuous flange. The closed design has been preferred in cases with three or fewer teeth available to retain the overdenture and to facilitate the conversion to a purely mucosa-borne prosthesis ***(Staubli, 1993).***

1.2.1.4 Impressions of the abutment Teeth:

1.2.1.4.1 One–stage technique with supporting element :

For designs that rest on abutment teeth without root copings, the full-arch impression is made as soon as the abutments are prepared. When root copings without retentive elements, the impression is made after the final cementation of the copings ***(Mandell, 1995).***

The full-arch impression is made in a custom tray similar to one for a conventional complete denture. It covers the entire ridge except for any undercut areas near the abutment teeth that could not be utilized for the future denture base in any way. The impression is made using Zinc oxide-eugenol paste or elastomer in the same manner as in the edentulous arch **(Fig.1-6)** ***(Mandell, 1995).***

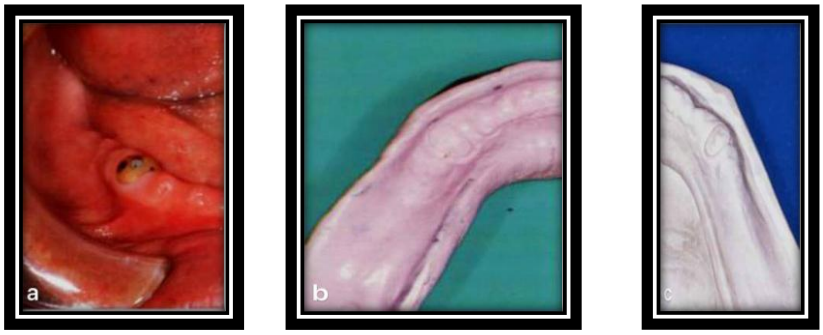

Figure (1-6): Abutment teeth without copings (a), Abutments that have no root copings and those that have root copings with no retentive elements allow the entire impression to be made as if the arch were edentulous (b), Copings and roots are duplicated merely as part of the working cast (c) ***(Mandell, 1995).***

1.2.4.1.2. <u>One-stage technique with the existing retentive element</u>

A single step full arch impression in Zinc oxide-eugenol paste or elastomer the materials used for overdenture that will rest on Pre-existing retentive elements Transfer matrices are set in place on the involved retentive elements and picked up in the impression. this makes it possible to incorporate retentive elements analogs in the working cast, using a custom tray similar to these used for a complete denture, the tray must touch neither the root coping nor the transfer matrices **(Fig.1-7)** ***(Mandell, 1995).***

Figure (1-7): Preexisting retentive elements and when a retentive element is already present، the procedure is similar to that in the case described above. The only difference is that a corresponding female attachment element is placed over the retentive element in the mouth before the impression is made (a and b). This serves as a transfer matrix and allows the technician to incorporate a male attachment analog into the working cast in the proper position (c) ***(Mandell, 1995).***

1.2.1.5 Record base

The only difference in the construction of the record bases for tooth supported overdenture and conventional dentures are the incorporations of the metal-bearing in the record base ***(Chrcanovic, Albrektsson and Wennerberg, 2014).***

1.2.1.6 Denture Base designing:

The design of the base is governed primarily by periodontal and functional criteria particularly near abutment teeth with retentive attachment، this means the root coping and denture base must be considered as a unit in form and function ***(Chrcanovic, Albrektsson and Wennerberg, 2014).***

1.2.1.7 Criteria for Designing the Base

1) Not unnecessarily promote plaque accumulation.
2) Not mechanically traumatize the marginal gingival.
3) Not impede the performance of good oral hygiene.
4) Not interfere with the normal function of the tongue, lips, and cheeks.
5) Not interfere with esthetics or speech ***(Mustapha, Salame and Chrcanovic, 2021).***

1.2.1.8 Basic rules of overdenture base design:

1. Cover as little of the marginal gingiva as possible.
2. Border the proximal spaces with metal.
3. The greater the number of abutment teeth and the better their prognosis، the more open the construction may be ***(Mustapha, Salame and Chrcanovic, 2021)*.**

1.2.1.9 Denture Base Design and the Periodontium:

The requirement of keeping the denture base circumventable open is based on the results of experimental studies in recent years. It is also supported by several clinical considerations and experiences concerned with maintaining periodontal health:

1- A base designed so that it does not cover the gingiva precludes direct mechanical trauma of the marginal gingiva by the denture base.

2- A base not covering the periodontium reduces plaque retention around the abutments by preventing entrapment of food. It permits the free circulation of saliva and a certain degree of self-cleansing.

3- A base that is open around each abutment makes it possible to clean the proximal surfaces of the root copings with interproximal brushes with the prosthesis in place. The proximal surfaces of the denture base serve as guiding surfaces that automatically direct the bristles of the interproximal brush toward the gingival margin. In this way, cleansing of the abutments, which is often very difficult because of the small size of the root copings, is made appreciably easier

4- A base design that leaves the periodontium uncovered prevents a suction effect from being induced by movement of the prosthesis which, combined with

the inadequate coping shape and poor oral hygiene, would otherwise lead to hyperplastic proliferation ("suction hyperplasia") of the gingiva.

5- The periodontally remote design prevents undesirable vacuum retention in maxillary overdentures with retentive attachments. torqueing and pulling forces necessary to overcome the combined retention of suction and retentive elements can traumatize the periodontium. This is another reason why the palate of a maxillary overdenture should not be extended to the vibrating line ***(Krennmair et al., 2019).***

1.2.2 Implant-supported overdentures

Edentulous patients with a sufficient amount of bony ridge on their jaws can use implant-supported overdenture. This type of overdenture gains supports from both the dental implants and intraoral tissues. Having implant-supported overdenture provides better stability of prosthesis and reduces bone resorption. However, a conventional complete denture can be considered an alternative due to less treatment time needed ***(Langer and Langer, 2000).***

The implant-retained overdenture is an acrylic resin removable denture، retained by implants, and may or may not be on the mucosa. The number and location of the implants, along with the various types of attachments، determine the variations in this type of prosthesis ***(Mundt et al., 2016).***

This is a less invasive, cheaper, and equally effective treatment option when compared to the fixed implant-supported prosthesis ***(Mundt et al., 2016).***

The choice between an implant-retained overdenture and a fixed implant supported prosthesis as an alternative to conventional dentures in edentulous mandibles suggests some questions, such as:

1. Implant survival.
2. Bone loss.

3. Patient satisfaction.
4. Quality of life as related to oral health.
5. Chewing efficiency.
6. The number of implants.
7. Cost ***(Fitzpatrick, 2006).***

1.2.2.1 Advantages of implant-supported overdenture

1-Improved denture retention and denture stability and stable occlusion reduced alveolar bone resorption (anterior mandible alveolar ridge height reduction 0.5 mm over 5 years and long-term resorption0.1mm annually compared with 0.4 mm).

2-An implant overdenture provides stability to the prosthesis due to which the patient is consistently able to reproduce a determined centric occlusion.

3-An Implant Overdenture increases chewing efficacy by 20% as compared to a traditional complete denture.

4-Maximum occlusal force of a patient with a denture may improve up to 300% with an implant-supported prosthesis ***(Jahangiri, 2011).***

1.2.2.2 Disadvantages of Implant-supported Overdenture

1-Physiologic (need for non-removable teeth).

2-Mandibular overdenture treatment plan requires more than 12mm of space between crystal bone and the occlusal plane.

3-Posterior bone resorbs faster than the anterior bone, implant prosthesis with posterior soft tissue, support may accelerate posterior bone resorption 2 to 3 times faster than a complete denture wearer ***(Jahangiri, 2011).***

1.2.2.3 Indications of implant-supported overdenture

1-Demand for greater retention for an existing mandibular denture.

2- Exhibiting advanced resorption of alveolar ridges.

3-Patients with decreased oral motor control (facial paralysis, Bell‟s palsy, elderly patients, Parkinson‟s disease) and decreased manual control.

4-Inter-arch clearance/discrepancy.

5- Horizontal discrepancy between upper and lower jaws ***(Kronström, Widbom and Söderfeldt, 2006).***

1.2.2.4 Contraindications of implant-supported denture

1-Debilitating or uncontrolled diseases.

2-Pregnancy and heavy smoking.

3-Conditions and diseases treatment that severely compromised healing e.g. radiation.

4-Inability of the patient to manage oral hygiene.

5-Patient hypersensitivity to a specific component of the implant ***(Kronström, Widbom and Söderfeldt, 2006).***

1.2.2.5 Number and location of implants:

During treatment planning for an overdenture, it is important to question not only whether there are an ideal number of implants that will maximize the retention of an implant-supported overdenture but also how their location (maxilla or mandible) affects the outcome ***(Ishida et al., 2017).***

1.2.2.5.1 Mandibular arch:

The compact bone structure of the mandible and its dense cortical plates make the largest facial bone a good recipient for implants. Several published studies have shown that patient satisfaction is higher with mandibular implant-retained ODs than with conventional dentures in the areas of stability, retention, chewing function, and even esthetics ***(Hohmann and Hielscher, 2016)***.

Treatment outcomes with mandibular overdenture appear to be more successful in comparison with maxillary overdentures, particularly for elderly patients ***(Zhang et al., 2017).***

Completely edentulous elderly patients can benefit from implant-supported overdentures when they lose their teeth at an advanced age and are not capable of adapting to wearing complete mandibular dentures or when, after having had dentures for many years, they begin to lose their motor skills and are no longer able to wear complete dentures ***(Zhang et al., 2017).***

Principles of treatment with mandibular implant-supported overdentures rely on the following clinical considerations.

1. Most elderly patients should be eligible for overdenture therapy.
2. Three implants can be placed if the minimum length of each implant is less than 8 mm.
3. Two implants should be sufficient to support an overdenture prosthesis.
4. Standard surgical procedure should be applied in most situations. **(Fig.1-8)** ***(Boven et al., 2014).***

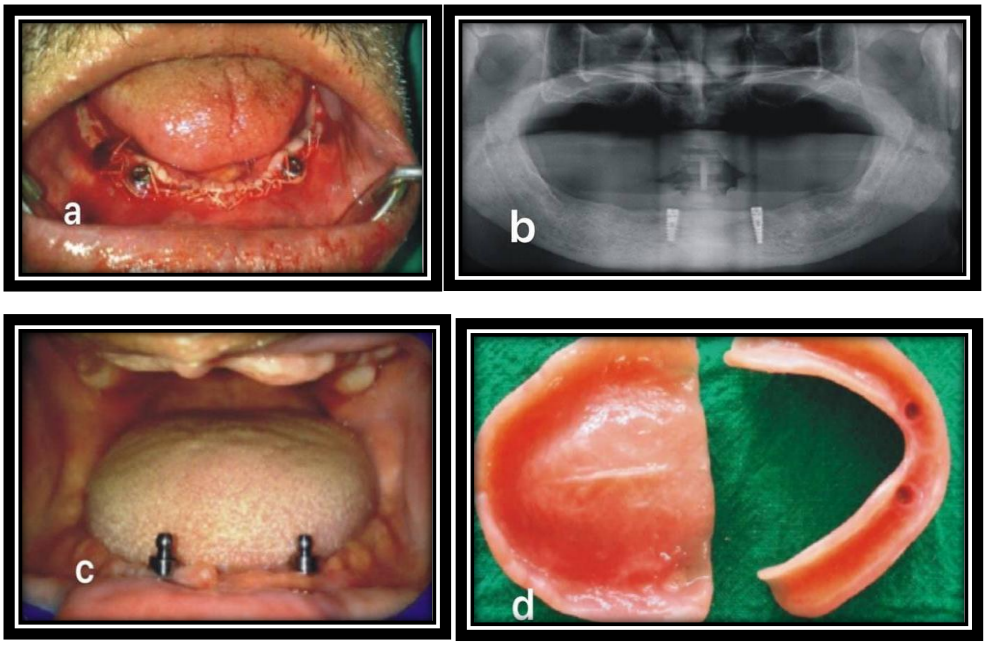

Figure (1-8): Two implants were placed in the mandible (a and b), Healing abutments were replaced by ball abutments into the implant (c), and mandibular

implant-supported overdenture against maxillary conventional denture (d) ***(Boven et al., 2014).***

1.2.2.5.2 Maxillary arch

Problems include the divergent and buccal-directed implant axis, long teeth, open inter-dental spaces, insufficient lip support, and incongruence of implant location and tooth position. Such adverse morphologic effects can be more easily eliminated by the use of maxillary implant-supported overdentures instead of fixed, a screw-retained prosthesis ***(Boven et al., 2014).***

The following are the basis of diagnostic and therapeutic criteria:

1-Minimal number of the required implant is preferably four.

2-Evenly distribution of implant throughout the arch.

3-Opposing mandible should be dentate or reconstructed with the fixed prosthesis.

4-Therapy with overdentures is more consistent with optimum placement of the implants concerning bone quality and quantity.

5-Overdentures may better resolve esthetic and speech problems.

6-Labial flange of the overdenture provides lip support.

7-Overdenture may have a horseshoe design, thus more acceptable to the patients **(Fig. 1-9)** ***(Hasti, 2019).***

Different studies have evaluated the high survival rates of implant-supported overdentures. The overall survival rate is 95% in the maxillary arches and almost 100% in the mandibular arches ***(Chrcanovic et al., 2014)***.

The influence of smoking on the failure of implant treatment has been validated in many studies ***(Bezerra Ferreira et al., 2016).***

Also, Peri-implant diseases are more common in smokers because they have increased marginal bone loss ***(Chrcanovic et al., 2015).***

Further, diabetes has been established as a risk factor for failure of implants supporting an overdenture; however, the exact relationship is yet unknown ***(Liddelow and Klineberg, 2011).***

Cardiovascular diseases are also a potential risk factor for marginal bone alterations ***(Krennmair et al., 2016).***

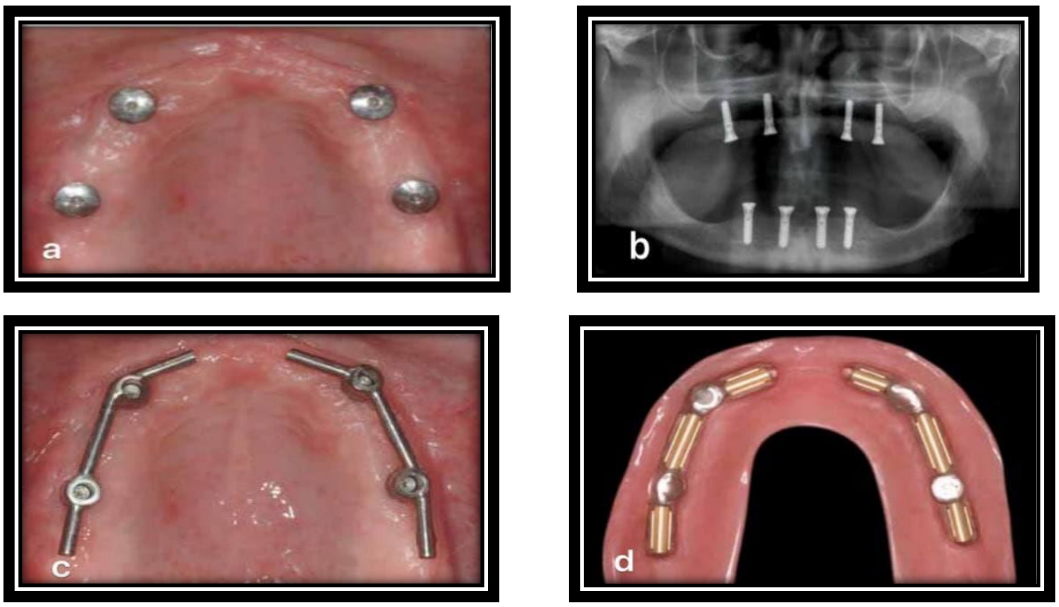

Figure (1-9): Four dental implants with cover screws in the edentulous maxilla (a and b), Intraoral view of milled titanium bar fastened to dental implants in the maxilla (c), View of the inner surface of maxillary overdenture with chromium alloy structure and clips (d) ***(Slot et al., 2012).***

1.2.2.6 Impression making methods of implants:

1.2.2.6.1 Closed-tray impression:

A coded impression cap is placed either directly on the implant or the screwed down impression post and the impression is made using a closed impression tray. The impression post and model implant must perceptibly click into place in the impression elements ***(Resnik and Misch, 2020).***

1.2.2.6.2 Open-tray impression:

It is particularly indicated for non-parallel inserted implants. The impression post is firmly the implant. After loosening the screw, the impression with the

integrated screwed impression post can be removed. For model fabrication, the model implant is firmly screwed to the impression

post. While the screw is being tightened, the model implant must be held at its retentive part. The impression is taken using a custom-fabricated, open impression tray ***(Resnik and Misch, 2020).***

1.2.2.6.3 A trayless impression technique:

Using this method, which was originally intended to facilitate impression making in the surgery, the steps of this technique are as follow:

a- For impressions at the time of surgery, place implant level transfer impression copings before suturing.

b- Leave the upper half of the impression copings exposed, and place fast-polymerizing vinyl polysiloxane impression material.

c- Place light-polymerized acrylic resin in manageable overlapping increments around the upper half of the impression copings.

d- Remove the impression and pour in the cast ***(Toth, 2005).***

This trayless technique facilitates making impressions in edentulous patients with restricted access. Considering the methodology used and the result obtained the direct impression technique with squared transfer copings with acrylic had better results than the other techniques studied ***(Cabral and Guedes, 2007).***

1.3 Precision attachments:

Precision attachment is a mechanical device for the fixation, retention, and stabilization of a prosthesis. It is a retainer consisting of a metal and a closely fitting part; the former, the female (matrix) component, is usually contained within the normal (intracoronal) or expanded contours of the crown (exrtacoronal) of the abutment tooth and the latter, the male (patrix) component, is attached to a pontic or the denture framework. ***(B, 2017).***

Precision attachment retained overdenture provides a better treatment modality in preventive prosthodontics for the edentulous patient if the patient is properly motivated regarding the maintenance of oral hygiene ***(B, 2017).***

The choice of attachment should be based on the pattern of stress distribution from these attachments through the abutments and other structures and not the retention and stability. The patient's physiological dimension is maintained through the preservation of teeth and bone ***(B, 2017).***

The attachment mechanism in the implant overdenture provides enhanced retention and stability compared to the conventional denture. The support is gained from both the intraoral tissues and dental implants. The connection should minimize denture movement without increasing the stress on the implants ***(Daou, 2013).***

1.3.1 Factors affecting precision attachment selection

The selection of precision attachment depends on several factors as follows:

1. Cost-effectiveness.
2. Amount of retention needs.
3. The expected level of oral hygiene.
4. Amount of available bone.
5. Patient‟s social status.
6. Patient‟s expectation.
7. Maxilla-mandibular relationship.
8. Inter implant distance.
9. Status of the antagonistic jaw. ***(Trakas et al., 2006).***

1.3.2 types of precision attachments

There are generally three different types of precision attachments available: **studs, bars, and magnets**

- **Studs:** are generally placed in the root face and the attachment, in the form of a press clip, is retained in the denture, Stud attachments consisted

of a female part which is frictionally retained over the male stud and incorporated into the denture resin either by the means of a transfer coping system and the creation of a master cast incorporating a replica of the attachment or directly in the mouth using self-cured or light-polymerized resin. The stud attachments are classified according to function into resilient and non-resilient attachments ***(El Khourazaty and Nassouhy, 2017).***

A- O-rings attachment

It consists of a titanium male unit and an easily replaceable rubber-ring a female unit that is retained in a metal retainer ring. It transfers the amount of stress to the abutments and provides an excellent shock resorbing effect during function **(Fig. 1-10)** ***(El Khourazaty and Nassouhy, 2017).***

Figure (1-10): O-ring attachment ***(El Khourazaty and Nassouhy, 2017).***

B- ERA attachment

It is an extra-radicular attachment with two design systems. The first is a partial denture attachment for placement on the proximal (mesial/ distal) aspects of artificial crowns, while the second is an axial (or overdenture) attachment, either for placement inside the prepared roots or the ERA implant abutment for an overdenture prosthesis. The abutments are available in two types, first is the straight one-piece abutment type and the

second is the two piece angulated abutment type (5°, 11°, and 17° angles) ***(Chiapasco and Gatti, 2003).***

- **Bars**: have the advantage of spreading the loading between the abutment teeth. However, they impart high loading to those teeth, are difficult to clean, and relining is complicated. The bar is attached to the root face via a post system and the clip or sleeve is held in the denture ***(Cheng-Yi and Jimmy LianPing, 2020).***

-There are two basic types based on the shape and the action performed:

Bar joints that permit some degree of rotation or resilient movement between the two components. Spacers should be provided to ensure a small gap between the sleeve and the bar during processing ***(Jain, Hemakumar and Sindhu, 2017).***

-Bar joints are subdivided into two types:

a) Single sleeve: the single sleeve has to run straight without allowing the anteroposterior curvature of the arch, so it is used in square arches.

b) Multiple sleeves: can follow the curvature of the arch. It also enables the use of more than one clip ***(Jain, Hemakumar and Sindhu, 2017).***

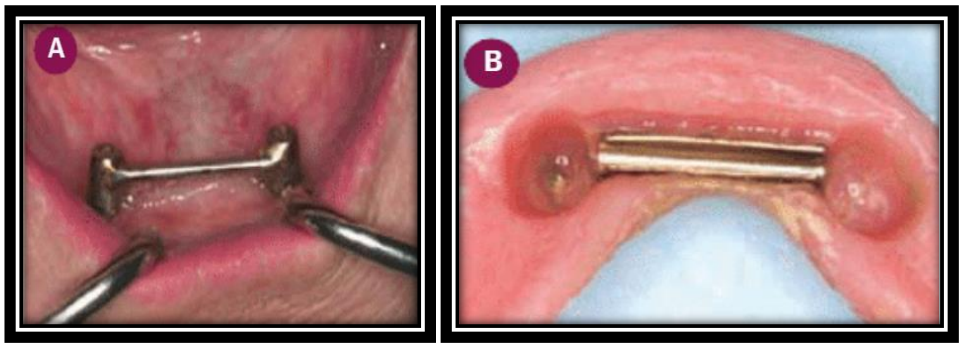

Figure (1-11): A clinical picture of a bar attachment system in which two implants are connected with the bar for an overdenture (a), A metal clip is attached to the fitting surface of the denture (b) ***(Bezerra Ferreira et al., 2015).***

- **Magnets**: used in dentistry are made from either cobalt— samarium or iron—neodymium—boron. They have the advantage that they are less likely to cause lateral stresses to the abutment tooth and are clinically easy to use. Their disadvantage is that they are liable to corrode in oral fluids over time. Special base metal is supplied for use with magnets, which are cast into copings and cemented into the root face. The magnets are positioned in the mouth and retained in the denture using a self-cure acrylic ***(Bezerra Ferreira et al., 2015).***

  The retention force of magnet attachments in implant-retained mandibular overdenture treatment is markedly less than the retention force of the ball and bar-clip attachments ***(Varshney et al., 2019).***

  The immediate loading of magnet attachment retained mandibular implant overdentures is considered a viable treatment option in cases of completely edentulous patients that increase retention and stability of conventional dentures ***(Pae, Kim and Kwon, 2010).***

Figure (1-12): A magnet attachment (magnet (A) and abutment (B)). The abutment is usually attached to the implant while the magnet is attached to the fitting surface of the overdenture ***(Bressan et al., 2011).***

1.4 Telescopic attachment

Telescopic crowns are also known as double crown, crown, and sleeve coping. These crowns consist of an inner or primary telescopic coping، permanently cemented to an abutment, and a congruent detachable outer or secondary telescopic crown, rigidly connected to a detachable prosthesis ***(Slot et al., 2012).***

The use of telescopic retainers has been expanded to include implant-retained prostheses to make use of their enormous advantages. These retainers provide excellent retention resulting from the frictional fit between the crown and the sleeve. They also provide better force distribution due to the circumferential relation of the outer crown to the abutment which makes the axial transfer of occlusal load that produces a less rotational torque on the abutment by improving the crown root ratio so preserving the tooth and alveolar bone ***(Liddelow and Klineberg, 2011).***

Telescopic retained restoration has the advantage of the ease of removability. This encourages the patient for repeated cleaning and maintenance purposes. Moreover, the overdentures self-finding mechanism in telescopic constructions facilitated prosthesis insertion considerably ***(Liddelow and Klineberg, 2011).***

Figure (1-13): Telescopic Overdenture and Implant-Supported Fixed Partial Denture ***(Liddelow and Klineberg, 2011).***

1.5 Maintenance of the overdenture

An important issue with this type of restoration is that patients must be informed that they will still have a removable prosthesis, the mucosa below the denture bases will still be loaded and continued maintenance of the prosthesis once delivered will be required ***(Zhang et al., 2017).***

The maintenance will include:

1. Regular relines of the prosthesis.
2. Regular replacement of attachments.
3. Good oral hygiene and prophylaxis of the implants and possible breakage of components ***(Zhang et al., 2017).***

The type of attachment system used can influence the frequency of prosthodontics maintenance events required. The cleaning of implants and overdentures is easier when compared with fixed full-arch prostheses. The wearing of overdentures certainly enhances plaque accumulation and the risk of inflammatory soft tissue reactions ***(Berger et al., 2020).***

Asymptomatic growth of hyperplastic soft tissue around implants and particularly underneath bars is common and usually rectified by a program of vigorous massage ***(Vahidi and Pinto-Sinai, 2015).***

1.5.1 Objective of regular recalls for patients with overdentures

1. .To check the overdenture for minor denture adjustments, retention، stability, occlusal adjustments, and maintenance of the attachment system.
2. .To monitor implant osseointegration with marginal bone loss and the health of the oral and peri-implant tissues ***(Berger et al., 2020).***

Chapter two

Conclusion

- The present work concluded that a substantial evidence is now available demonstrating that patients‟ satisfaction and quality of life with overdentures is significantly greater than for conventional dentures.

- There is now overwhelming evidence to support the proposal that an overdenture should become the first choice of treatment for dentulous and edentulous patients.

- A review of the current literature regarding the influence of the attachment mechanisms on the outcome of the implant-retained overdenture treatment has been presented for the clinician to understand the differences and disadvantages of each method.

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