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Attachment Systems Retained Implant Overdentures: an Overview

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Abstract:

The most common prosthetic problems in mandibular and maxillary dentures are lack of retention, stability and continue residual ridge resorbtion. So the patient needs greater retention to use their dentures. Attachment systems have been used for improving the retention and stability of implant supported overdentures in edentulous arches. Variety of commercially available attachment systems are used to retain implants overdentures. The attachments include stud, magmatic, telescopic and bar attachments. In the present article, were reviewed the literature concerning the types and design of attachments systems currently available. Keywords: Types, and Systems of Attachment, Literatures Review

Introduction:

There are some problems in the treatment of fully edentulous patients such as residual ridge resorbtion, excess salivary flow, muscle tone reduction, and the retention quality of complete dentures. These patients need more retention for chewing and psychological reasons. (1) The retention is one of critical factors for determining patient satisfaction with removable prostheses. (2) The amount of retention that clinically acceptable depends on the amount of dislodging forces, the performance of the prosthesis during function, and the patient's ability to place and remove the prosthesis. (3)Implants and attachments provide greater retention for the removable denture. (4) Attachments can be defined as mechanical device for fixation, retention and stabilization of prosthesis. It made up of two or more parts; a retainer consisting of a metal receptacle and a closely fitting part. The former (the female matrix component) is usually contained within the normal or expanded contours of crown of the abutment tooth and the latter (the male patrix component), is attached to the denture framework. (5) Attachment systems have been traditionally employed as a mean of improving the retention and stability of tooth or implant supported overdentures in edentulous or partially

edentulous arches. [6] Therefore can be improved patient satisfaction, psychological profile, and emotional status.[4]

On other hand, Fracture and loosening of the attachment system in the overdenture is said to be the most common prosthetic complication with mandibular and maxillary overdenture treatment. [7] Also the cost of attachment is higher because the metal reinforcement and the laser welding needed to attach the clips are extra components in the overdenture. [8]

A wide variety of commercially available attachment systems are used to connect implants to overdentures either by splinting or un-splinting the implants, most commonly used include stud, bar, magmatic, and telescopic attachments. Shafie[9] stated that an attachments selection criteria according to, financial ability of the patient to cover treatment costs, personal choice and clinical expertise of the dentist, and experience and technical knowledge of the laboratory technicians. Also should allow for easy placement and removal of the prosthesis by the patient.[10] Un-splinting attachments: The separate attachments are easily used, less expensive and less space is needed relative to splinting attachment than bar attachment. Moreover, absolute parallism between the abutments is critical with ball attachments than with bar attachments. [11] Un-splinting attachment included:

1- **Stud attachments**:

Stud attachments consist of a female part which is frictionally retained over the male stud and incorporated into the denture base 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.[12]One of the main advantages of stud attachments is the ability of its use in cases with V-shaped arches where straight connection between the implants can affect the tongue space.[13] Stud attachments are classified according to function into resilient and non-resilient attachments. Resilient attachments permit some tissue ward vertical and rotational movements, thus protecting the underlying abutments or implants against overload. However, resilient attachments usually require a large space and might cause posterior mandibular resorption with the vertical movement of the denture. On the other hand, the non-resilient attachments do not permit any movement of the overdenture during function and were commonly employed when the inter-

occlusal space was limited.[14] Stud attachments include:

A-

B-

C-

D- **O-rings attachment**:

It is consists of a titanium male unit and an easily replaceable rubber-ring 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.[15] Rodrigues et,al have evaluated that, the retention force of an O-ring attachment system in different inclinations to the ideal path of insertion and concluded that when the O-rings attachments were properly placed parallel each other, the retention were adequate for longer time and the retentive capacity of O-ring was affected by implant inclinations. [16]

a- **Ball and O-rings:**

are commonly used because they have many advantages of design simplicity, ease of use and maintenance, less costly than other attachments options, times effective, and they offer more occlusal and bucco-lingual spaces for artificial teeth which is favorable especially in the anterior maxilla, varying degrees of retention. [17] The disadvantages of O-ring attachment include wear of the O-ring with gradual loss of retention, and the need for periodic replacement from six to nine months depending on the complexity of the prosthesis, the chewing and dietary habits of the patient and the ease in insertion and removal of the prosthesis. [18] Also, Limited inter-arch space often restricts the prosthetic armamentarium to low-profile attachments and prevents the use of O-ring attachments. [19]

b- Ball and socket attachments:

The ball and socket attachments consist of a metal ball (male portion) which is screwed into the fixture, where the female part is incorporated in the fitting surface of the denture. The female part may be one of the following types:

1- The O-ring in which the retentive element is rubber ring. It's better to have parallel implants otherwise the rubber ring will wear within a few weeks.

2- A metal part as in Dalbo system. This permits less resilience however the

retentive forces are almost twice those obtained with the O-ring system.

attachments have advantage of being resilient and easily activated. [20] Many authors agree that for un-splinted implants, the most common attachment used is the than bars. Moreover, the potential for mucosal hyperplasia was more reduced with solitary ball attachments but bars were shown to be more retentive. [22] Naert et al [23] had suggested that, the use of ball attachment was advantageous in regards to optimizing stress and minimizing denture movement. Another study was done to compare the retention of bar/clip, ball and magnet attachment in mandibular implant retained over denture. The ball and socket attachment recorded the highest value

3-A spherical metal anchor in which the female part contains a spring. Thes ball attachment. [21] Ball attachments were claimed to be less costly, less technique sensitive and easier to clean

followed by the bar/clip then the magnet attachment. [24] After 3-years of prospective study for implant-supported mandibular over dentures either retained with ball, bar or telescopic attachments, the authors found that implant success and peri-implant condition did not differ between both attachments but the ball attachment showed significantly higher frequency of technical complications than that of telescopic and bar attachment in implant supported overdentures. [21]

B- Locator (self-aligning) attachment:

The Locator attachment has quickly become one of the most popular implant overdenture attachment used because it has many advantages such as; the self-correcting alignment of the Locators reduce wear and tear on the attachment components by directing proper insertion of the appliance every time even when patients bite their dentures into place.[25] Locators have unique dual retention innovation (a combination of inside and outside retention) which provides the Locators with greater retention surface

area than other attachments. Moreover, independent laboratory testing had demonstrated the high level of wear resistance inherent in the dual retention design. [26]One of the greatest advantages of Locator attachment is resiliency. The vertical resiliency should be provided for stress relief. The Locator attachment allows movements in both vertical plane and the hinge axis.[10] The retentive force of the Locator, ball and Magnetic attachments is gained through mechanical interlocking, frictional contact or magnetic

forces of attraction between the patrices and matrices. An ideal attachment system should provide a high and stable retentive force with a low lateral force to the implant, not only in the parallel placement of the implant, but also in the implant inclination during recurrent dislodging.(27)

C- Equator:

The use of new connecting beams with implant through the tabs Equator using elastic rings "Seeger" placed in special cylinders' form prefabricated along ring. This cylindrical contained is maintained in place, acting in good fixation used in restorations (28) , and extra radicular attachment with the female part (metal cap) inserted in the overdenture and male part projecting from the implant. (29)Equator attachment system offers the lowest profile and has the least overall displacement of any attachment system in the market giving the dentist and the technician superior case design options for esthetics and function, especially where space is limited. (30) It is the ease of use and increased retention force. At the same time, it should be noted that this retention system is compatible when all the available systems most implant. (31)

D- Extra-coronal resilient attachments (ERAS):

Extra-coronal resilient attachments are an extra-radicular with two design systems. The first is a denture attachment for placement on the proximal (mesialdistal) aspect 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 overdenture prosthesis. The abutments are available in two types; first is the straight one-piece abutment type and second are the two pieces angulated abutment type. Each ERA retentive system is available in four color codes (white, orange, blue and gray).(32) It is indicated when resiliency is required as it provides vertical resiliency and universal stress relief.). (33)Extra-coronal resilient attachments have demonstrated appropriate mechanical resilience, retention and stability. The main advantage of ERA attachments, when compared to implant supported prostheses, removable partial dentures retained by ERA has lower costs and a shorter time span for fabrication. (10)

2- Telescopic attachments:

Telescopic attachments consist of an inner or primary telescopic coping permanently attached to the abutment and a detachable outer or secondary telescopic coping attached to a removable prosthesis. The secondary coping engages the primary coping forming a telescopic unit that retains the prosthesis. [34] The advantages of telescopic attachments include: good frictional retention and stability, splinting in cases when bars are contraindicated

irretrievability and facilitates hygiene, self-seating mechanism which allows its use in patients with physical dexterity and less technical complications and maintenance. [35] In three years of prospective study for implant assistant mandibular over dentures either retained with ball, bar or telescopic attachments, the authors found that implant success and peri-implant condition did not differ between both attachments but the ball attachment showed significantly higher frequency of technical complications than that of telescopic and bar attachment in implant assistant overdentures. [21]The disadvantage of telescopic crowns has shortcoming which is the attachments used is difficult and long time in fabricating them, causing increase in cost. Moreover, retention reducing induces mechanical wear of copings. [36]

3. Magnet attachments:

Magnet attachments consist of two parts that attract each other by means of magnetic flux field for increasing retention and stabilization of the overdentures. A Magnetic attachment requires two elements where one of them would be fixed on an implant and the other in the denture. [37] A magnetic system consists of Magnet fixed in the denture base and a corresponding Magnetic attachment keeper that has either the form of a post with a dome on top to cover the remaining root or of implant abutment. These corresponding anchors are made of either a “soft” Ferro-magnetic alloy, which can easily be magnetized and has no static magnetic field of their own.[38] Magnet attachments are indicated for patients with physical disabilities, such as elderly or arthritic patients, because the path of the insertion of the denture was unaffected by the retainer. The magnetic unit offers little lateral resistance to displacement, which reduce the potentially damaging lateral force directed by a denture onto a tooth or implant.[39] There are many advantages offered by magnets in comparison with un-splinted attachments that include low profile, enabling them to be used in cases of inadequate inter-arch space. [40] On

other hand, the resistance of magnets for vertical denture dislodgement forces is significantly lower than those of bar clip and ball attachments after 90 days of function. [41] Moreover, Magnets are associated with reduced stability of the prostheses and decreases patient satisfaction.[42]

Bar attachments

The bars are one of the most popular retention aids for implant assistant supported overdentures because of the improved retention and stability associated with them and their splinting effect.[43] The bar systems are used to splint the implants and they provide different degrees of movement towards the tissue, depending on the specific cross-sectional shape. [44] The bar attachment consists of a metallic bar that splints two or more implants or natural teeth spanning the edentulous ridge between them and a sleeve (supra-structure) incorporated in the overdenture which clips over the original bar to retain the denture. [45] The bar attachments are available in wide variety of forms, they could be prefabricated or custom made [46], and there are two basic types based upon the shape and the action performed. [47] Bar joint permits some degree of movement around the bar during mastication. Bar joint is resilient, providing vertical resiliency, hinge resiliency or both. [48] Examples of this group are the Hader bar joint, Ackermann bar, Baker clip, Dolder bar joint and Ceka bar joint. Bar joints are subdivided into main two types: single sleeve and multiple sleeves. The single sleeve has to run straight without allowing the anterio-posterior curvature of the arch, so it is used in square arches. On the other hand the multiple sleeves can follow the curvature of the arch. It also enables the use of more than one clip. [47]

Bar unit

is a non-resilient attachment that provides rigid fixation of the overdenture. It has parallel walls that prevent rotation or vertical movements of the prosthesis. [49] Examples of this group are Ceka bar units Milled bar, and Dolder bar units.The bar and clip attachments are probably the most widely used attachments for implant tissue support overdentures as they offer greater mechanical stability and more wear resistance than solitary attachments. In addition, short distal extensions from rigid bars can be achieved which contribute to the stabilization and prevent shifting of the denture. [22]

Conclusion:

The attachment assisted implant overdenture resolves many problems associated with conventional complete dentures. There are many types of attachment systems currently available. The selection of these attachments depend on factors such as amount of retention needed, available inter arch space, manual dexterities of the patient.

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