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Attachments Used With Implant Supported Over Denture

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Abstract

A wide variety of commercially available attachment systems are used to connect implants to overdentures. Most commonly used attachments include stud, bar, magmatic, and telescopic attachments. In this review article, author reviewed the literature concerning the types, designs, and requirements of attachments systems.

Keywords: Attachment System; Dental Implant; Over denture

Introduction

Edentulism is considered a poor health outcome and may compromise quality of life. The prosthetic management of the edentulous patient has long been a major challenge for dentistry. The classical treatment plan for the edentulous patient is the conventional complete denture. However, this treatment has several complications that occur more frequently on the lower denture; this led the researchers to focus more on the mandibular jaw. Therefore, the problem of stability and retention of a complete denture is partially solved with the use of an implant retained denture, commonly known as an implant overdenture. A wide variety of commercially available attachment systems are used to connect implants to overdentures either by splinting or unsplinting the implants, most commonly used include stud, bar, magmatic, and telescopic attachments.

Review of Literature

An attachment is defined as "a mechanical device for the fixation, retention, and stabilization of a prosthesis ,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 the crown of the abutment tooth and the latter (the male patrix component), is attached to a pontic or the denture framework" [1]. Attachments used in conjunction with implants were found to enhance the retention, the stability and support of over dentures together with the implants, thus extending their longevity [2]. A wide variety of commercially available attachment systems are used to connect implants to over dentures either by splinting or unsplinting the implants. The anatomic situation of the mandible, desired level of retention, hygiene maintenance capability, parallelism of the implants and cost considerations are important factors in choosing the appropriate over denture attachment type [3-5]. The selection of the attaching mechanism for an implant-retained over denture depend on : cost effectiveness, amount of retention needed, expected level of oral hygiene, amount of available bone, patient's social status, patient's expectation, maxilla mandibular relationship, inter-implant distance, and status of the antagonistic jaw [6].

According To Retentive Means The Attachments Can Be Classified Into

Frictional, mechanical, frictional and mechanical and magnetic attachments [7]. 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 [8]. Attachments used to connect the denture and implants are fabricated either by machine milling an alloy or custom casted from plastic patterns. Machine-milled attachments are commonly used on the individual implant, while custom-cast attachments in the bar design are popular. Both designs have shown satisfactory results in terms of implant success and patient satisfaction [9,10]. The attachments used to retain implant over denture include stud, bar, magnets and telescopic attachments.

Stud attachment

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 [11]. The 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 type do not permit any movement of the overdenture during function and were commonly employed when the interocclusal space was limited [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 [13,14].

Stud attachments include

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. 2009) evaluated 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].

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 over denture) attachment, either for placement inside the prepared roots or the ERA implant abutment for over denture prosthesis. The abutments are available in two types, first is the straight one piece abutment type and second are the two piece angulated abutment type (5°. 11° and 17 angles). Each ERA retentive system is available in four color codes, (white, orange, and blue, gray), that provide different degrees of retention from light to heavy. It's indicated when resiliency is required as it provides vertical resiliency & universal stress relief [17].

Ball 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:

(a)- 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.

(b)- 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.

(c)- A spherical metal anchor in which the female part contains a spring. These attachments have advantage of being resilient and easily activated [18].

Ball attachments are among the simplest of all stud attachments widely used because of their low cost, ease of handling, minimal chair side time requirements and their possible applications with both root and implant-supported prostheses [19]. Many authors agree that for unsplinted implants, the most common attachment used is the ball attachment. This attachment system is a practical, effective, and relatively low-cost prosthetic concept [15,20,21]. Solitary balls were claimed to be less costly, less technique sensitive and easier to clean than bars. Moreover, the potential for mucosal hyperplasia was more reduced with solitary ball attachments. However bars were shown to be more retentive [22-24]. Naert et al [25] concluded that the ball attachments are the best regarding soft tissue complications, and patient satisfaction when compared to the bar attachment and the magnet attachment. One of the studies done, that compared load transfer and denture stability in mandibular implant retained over denture retained by ball, magnet, or bar attachments, suggested that the use of ball attachment was advantageous in regards to optimizing stress and minimizing denture movement [26]. 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 followed by the bar/clip then the magnet attachment [27]. In comparison, done between over dentures retained by ball and socket attachment and another design retained by two clips on a bar connecting the two implants, regarding stresses on the peri implant bone. The result revealed that stress on peri implant bone was greater with the clip/bar than that of ball attachment [28]. 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 [20].

Locator (self-aligning) attachment

The locator attachment system is an attachment system with self-aligning feature and has dual retention (inner and outer).

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Locator attachments come in different colors (white, pink and blue) and each has different retentive value. Additional features are the extended range attachments, which can be used to correct implant angulation up to 20° they are offered in green, which has standard retention, and red, which has extra-light retention [29]. The reduced height of this attachment is an advantagous for cases with limited interocclusal space or when retrofitting an existing old denture [30]. A laboratory study investigated the properties of this attachment founded that short profile distance of locator may affect the load transfer to the implant .The rounded edges of the abutment help to guide the nylon male within the denture into place (self-aligning feature) [31]. Locator attachment will also accommodate divergent implants up to 20 degrees. A variety of abutment heights, angulations correction and different levels of retention are available that help to create the optimum overdenture restoration for each case [32]. In a study evaluating the clinical performance as well as patient and clinician satisfaction on two different prosthodontic retention systems (locator and bar) for implant-over dentures in the mandible, the authors emphasized that patient satisfaction was similar in both groups; the locator system demonstrated better soft tissues scores, however, the frequency of chronic inflammations around the implants was more around bars attachment group [33].

Magnet attachments

Magnetic retention is a popular method of attaching removable prosthesis to either retained roots or osseo integrated implants. The magnet is usually cylindrical or dome shaped attached to the fitting surface of the acrylic resin base of the over denture. The magnetic keeper casted to a metal coping cemented to root surface or screwed over the implant fixture [34]. The magnet system used for over denture retention incorporates the magnet into the overdenture which is a neodymium-iron-boron alloy or a cobalt-samarium alloy. The second part of the magnetic system is the ferromagnetic keeper which is screwed into the implants [35].The retention force of magnet attachments in implant-retained mandibular overdenture treatment is markedly less than the retention force of ball and bar-clip attachments [27]. The immediate loading of magnet attachment-retained mandibular implant overdentures is considered as a viable treatment option in cases of complete edentulous patient that increase retention and stability of conventional dentures [36].

Bar attachments

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 (suprastructure) incorporated in the over denture which clips over the original bar to retain the denture. The bar attachments are available in wide variety of forms, they could be prefabricated or custom made [37]. There are two basic types based upon the shape and the action performed**.** Bar joint 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. Bar joints are subdivided into two types: single sleeve and multiple sleeves; the single sleeve has to run straight without allowing the anteroposterior 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. Bar units that provide rigid fixation of the over denture allowing no movement between the sleeve and the bar [34]. The prefabricated bars are preferred to milled bars as they are less expensive and more solid with an equal cross section. Prefabricated bars are either round, ovoid or rectangular (U-shaped). Round bars offer more denture rotation than rectangular bars, so produce less torque on implants. However, Round bars require more frequent clip activation than U-shaped bars. Therefore oval or U-shaped bar are preferred when using two implants [38]. The bar and clip attachments are probably the most widely used attachments for implant-tissue supported over dentures 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 [11,39,40].The assumed advantage of bar attachment is better transmission of forces between the implants due to the primary splinting effect, load sharing, better retention and the least post insertion maintenance [18,27].

Telescopic attachment

Telescopic crowns are also known as a double crown, crown and sleeve coping (CSC). 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 [41]. 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 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 make axial transfer of occlusal load that produce less rotational torque on the abutment by improving the crown root ratio so preserving the tooth and alveolar bone [42]. According to wall design telescopic retainers can be classified into parallel sided crowns. tapered (conical shaped) crowns and crowns with additional attachments [43]. Telescopic retained restoration has the advantage of the ease of removability. This encourages the patient for repeated cleaning and maintenance purposes. Moreover, the over dentures self-finding mechanism in telescopic constructions facilitated prosthesis insertion considerably. This construction seemed to be an effective treatment modality for geriatric patients with serious systemic diseases as in Parkinson's diseases [44].

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Conclusion

- The attachment retained implant supported over denture solves the problems inherited with conventional denture.
- The selection of attachment system depend on amount of retention needed, available inter arch space ,manual dexterities of the patient and skills of the dentist.

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