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Case report

Improving the Retention of Maxillary Complete Denture: A Case Report

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ABSTRACT

Complete dentures play an essential role in restoring oral function and improving the quality of life for individuals who have missing all their normal teeth. One of the key factors determining the success of complete dentures is their retention, which refers to the ability of dentures to stay securely in place during normal oral function. Adequate retention is essential for proper speech, mastication and overall comfort of the denture wearer. The study aimed to improve the retention of complete dentures through three different approaches: spacer, posterior palatal seal area, and undercut area. Three dentures were fabricated using the same steps, with variations in certain steps based on the retention technique being employed. The study showed that all three dentures had improved retention compared to standard complete dentures. The dentures that included the posterior palatal seal area and spacer demonstrated higher retention than the denture that employed the undercut technique. It is worth noting that the patient did not find the denture with the undercut technique satisfactorily.

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INTRODUCTION

Due to varying personal oral hygiene habits, an absence of access to preventive oral care, or a failure to afford dental care, the periodontal disease can become a problem for adults [1]. It is estimated that over 70% of people older than 65 have some form of periodontal (gum) disease, which is the primary reason that people miss their teeth. Or they may be losing their teeth for any other reasons, such as an accident. Therefore, after that they will think about a specific way to solve these problems [2]. The choice between some treatment selections for changing lost teeth is achieved by dentist and patient important factors, Replacement of missing teeth is one of the best significant requests for patients attending clinics to return esthetics and/or function [1].

Several treatment modalities are offered for exchanging missing teeth; removable partial denture, fixed partial denture, or dental implant. Removable dentures became popular many decades ago with the introduction of acryl polymers and chrome cobalt alloys in dentistry. The best restoration usually used is removable complete dentures. And the most part that important is the base. That is why it should have superior properties such as, retention, and stability [3].

A complete denture (also known as a full denture, artificial teeth or plate) is a removable appliance used once all teeth within a jaw have been lost and need to be prosthetically changed. It's completely different compare to a partial denture a complete

denture is constructed when there are no more teeth left in an arch, hence it is a totally tissue-supported prosthesis. A complete denture can be disparate by natural dentition, a partial or complete denture, fixed appliances or, sometimes, soft tissues. The success of a conventional complete denture treatment might be affected by some reasons such as patients' age, personality, prior denture wearing practice, expectations, aesthetics, residual ridge form and anatomy, denture quality, the technique of its manufacture, dentist experience, and dentist-patient relations [4]. In addition, most important factor in the success of the denture is good retention, which causes the denture to remain in place when the jaws are apart, such as when laughing and speaking. Moreover, good constancy avoids the dentures from skidding when the jaws are brought together, as in chewing or swallowing [5]. Furthermore, good support avoids the dentures from dropping toward the tissue below load of mastication [6]. Beside this, the steady of dentures is more significant thing for patient. As, if the complete denture is stable, it will do the function very well. Furthermore, this is will get by improving the retention of the complete denture by all the methods it can do.

Dentists should aim at producing good quality dentures to increase the comfort and function of the patient. Retention plays a vital role in the acceptance of the complete denture, and consequently each step of denture construction should be given due importance. Effective retention is reached by the close mucosal contact of the denture base [7]. The physical factors that arbitrate the retention of a complete denture are adhesion, cohesion, salivary film width, surface tension, and atmospheric pressure [8]. The larger the surface tension and thinner the fluid film, the greater will be the retention [8]. Denture base resin polymers were presented in 1937, and even today, polymethyl methacrylate (PMMA) is the material of excellent choice for the construction of the common dentures. The polymerization procedure causes the shrinkage that led to reduce in the dimensional of the resin. The shrinkage occurred as a difference in the densities of the monomer and the polymer that results in a lifting of the denture base away from the posterior palate area [9].

There are several things to improve the stability of dentures such as adhesives. Denture adhesive is defined as a material used to adhere a denture to the oral mucosa. Denture retention depends on cohesion, atmospheric pressure surface, tension, and viscosity. On the other hand, denture adhesives increase retention and stability for ideal as well as for compromised ridges [10]. However, these adhesives showed carcinogenic changes in the underlying tissues. Based on this the denture adhesive should be properly used, to advances retention, stability and masticatory function. Also, a proper advice must be given to denture using patients about the risk of prolonged overuse of denture adhesives and dentists should admonish their patients to limit their use of denture adhesive in accordance with manufacturers' instruction [11].

There are many studies have found more than one technique to advance the retention of complete denture. [12,13] stated that the complete denture construction must satisfy certain basic principles about stress distribution and ideal tissue preservation and good retention, stability and support are the prime requisite for a well-fitting prosthesis.

Denture flange or undercut area is defined as the part of the denture base that extends from the cervical end of the teeth to the denture margin [14]. Posterior palatal seal area defined as area the soft tissue area at or beyond the connection of the hard and soft palates on which pressure, within physiologic limits, can be applied by a complete denture to help in its retention [15, 16]. According to [17, 18], there are various forms of it. Relief or spacer is a rest cut into the base of a denture to decrease or eliminate possible pressure on a specific area [19]; it may be used on the palatal surface of a complete denture with the intention of improving retention by creating negative pressure [20]. A relief area is an area on a plaster model defined to relieve pressure on the tissues underneath a denture base.

The case study was done by using different mechanical approaches to enhance the retention of a complete denture. The three methods were posterior palatal seal area, spacer and undercuts.

Case study

A 59 years old female patient reported to the Department of Prosthodontics for replacement of her previous complete denture with primary complaint of losing the retention in the maxillary denture. The patient was diabetic and his intra-oral examination showed extremely resorbed ridges in maxillary arch. He had been wearing this denture for the past 4 years. He is suffering from complete tooth damage in the upper jaw and missing teeth in the back of the lower jaw. He is feeling instability, poor oral hygiene and impaired chewing function due to the inefficiency of his existing full dentures. In addition, diagnoses showed that the patient had a tapering face form, U-shaped arch with proclined anterior maxillary ridge and a deep labial undercut.

After the patient has visited the clinic and diagnosed the condition correctly. The patient's first impression was taken and the primary cast was made. After that, the special tray was made to take the final impression from which the master cast was constructed. The occlusion block was produced and the bite registration was taken. In addition, the bite registration was

transferred into the articulator to start the setting of the teeth as shows in Figure 1: A. After all the teeth were properly set up, the extra wax was added around the teeth and the gingival contours were building up accurately. The retention process including the undercut area was done for one of the complete maxillary dentures as shows in figure 1: B.

(a) **(b)**

Figure 1. a) Setting of the teeth; b): The denture included the retention by undercut area

After the patient try in the three dentures, it will be ready to be processed. The wax was eliminated by flasking technique and the flask is then opened till the all wax flushed out leaving the teeth and the denture mold to be filled with acrylic. After this step the two methods of retention of dentures were done. First one that, the denture which improve the retention with butterfly or posterior palatal seal area. The technique was to draw line on the last part of the palate with the very attention of the fovea palatine. The thick of it was around 2 mm extended through to the last part of the upper denture from the tuberosity to another side as shows in figure 2a.

The technique of spacer was named Murow, Rudd and Rhoads and Roy Mac Gregor [19] as shows in figure 2b and figure 3. If the spacer didn't include in the previous steps, it can do it in this step. It is recommended placement of a sheet of metal foil in the region of incisive papilla and mid palatine raphe. It is based on the selective pressure technique. The acrylic was packed into the flask and the dentures were cured under pressure until the accurate hardness is reached. In addition, the dentures were cleaned and finished using different burs such as round, pear, cylinder, inverted cone and cross-cut tapered fissure to remove any additional acrylic around the edges and palatal area.

(a) **(b)**

Figure 2. a): Maxillary denture included the posterior palatal seal area; b): Maxillary dentur included Murow, Rudd and Rhoads spacer

Figure 3. Maxillary denture included Roy Mac Gregor spacer

RESULTS AND DISCUSSION

There are various of pressures and causes that jointly hold the dentures in the mouth. Not all these influences effort at the same time. Some of these factors only do when needed to get or to resist a specific style that can release dentures. These are enabling factors for the characteristics of retention, stabilization and support. As mentioned earlier retention is the value that related to ability of attachment to a dental prosthesis against all the forces and pressures applied to it through the mastication and speaking function. Denture retention is resistance to the power which removes it from supporting tissue, especially in the standing order.

As previously stated, the most significant part in the production of maxillary complete denture is improving the retention. In addition, there are many ways of improving the retention. In particular, different form of spacer, different forms of posterior palatal seal area and undercut forms.

The posterior palatal seal area was designed to closely adapt to the contours of the soft palate. This close adaptation helps in achieving maximum coverage and contact between the denture base and the underlying tissues. It minimizes the potential space for air to enter, improving the suction effect and retention of the denture [21]. When the patient was wearing the denture, the posterior palatal seal area creates a vacuum-like effect between the denture base and the soft palate. This suction effect enhances the stability and retention of the denture during functional activities like speaking and eating [22]. The results showed that, the posterior palatal seal area is essential for earning best retention of upper full denture. In addition, it increased the stability of the denture. Especially, among the “scraped” type of posterior palatal seal evaluated. The “butterfly” shaped posterior palatal seal showed superior retention if it compared with other forms of posterior palatal seal area that “single bead” and “double bead”. This was in agreement with [23] who stated that in their study.

The place of the posterior palatal seal area is the most important in the maxillary denture. In this case (as shows in Figure 4: (a) the placement of the correct posterior palatal seal area is not a difficult process once the anatomy and physiology of the area is understood. Especially when a careful examination has been done through the diagnostic phase of the treatment and following established techniques for the placement of the border of the posterior palatal seal area. Moreover, it is proving to success the complete denture. In addition, the patient stated that the denture is stable at all the function of the mouth and it is very comfortable for him. This was in agreement with [24] who stated that for retention of the upper denture through functional actions of the stomatognathic system such as mastication, deglutition and phonetics and it must maintain contact with the anterior part of the soft palate. Properly incorporated posterior palatal seal into the prosthesis also aids in decreasing of gag reflex, reduce food accumulation beneath the posterior aspect of the denture, reduce patient's discomfort when contact occurs between the dorsum of the tongue and the posterior end of the denture and the thickened area provides added strength across the denture.

The spacer, as shows in figure 4b, was a second type of retention used in this study. It had a big effect in the retention of the complete denture and the dentist needs to select the spacer design for the success of the prosthesis [19]. It is recommended to place a sheet of metal foil in the area of incisive papilla and mid palatine raphe, based on the selective pressure technique [19]. Stated that the other areas which must be relieved are the maxillary rugae and buccal surface and the prominent tuberosity. Furthermore, it is not necessary to provide relief normally in the denture.

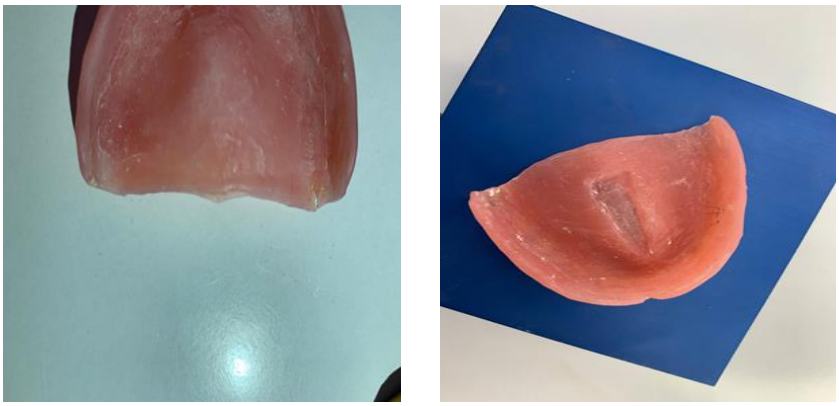
Spacers can play a role in enhancing the fit and stability of the denture. Spacers can provide extra support to the underlying oral tissues, particularly in areas where the ridge is resorbed or where there are undercuts. By filling in these spaces, spacers help prevent the denture from moving during function. According to [25], spacers can create a seal between the denture base and the oral tissues, helping to improve suction and maintain a better fit and reducing the chances of the denture becoming dislodged. Spacers distribute the forces employed on the denture more regularly across the underlying tissues thus minimize the pressure points and patient discomfort, enhancing the overall comfort and stability of the denture [26].

It's important to note that the design and placement of spacers should be carried out by a dental professional, such as a prosthodontist or a denturist. They will consider the individual's oral anatomy, denture fit, and specific needs to determine the appropriate type and thickness of spacer to use.

As mentioned earlier, there are many types of spacers. Each type was related with the patient case. In this study, the suitable type of spacer was Murow, Rudd and Rhoads and Roy Mac Gregor [19]. Which that were the best one to get the best retention. The patient was very satisfied with it because it reduced both the pressure and forces in the region of incisive papilla, mid palatine raphe and the sites of the ridge. In addition, the patient in this type, it was not feeling any different between it and the last denture and the new one. That is why, this type of spacer was more comfortable than the last one. The patient stated that, it was better retention and very stable especially in mastication [27,28]. Explained that spacers can help distribute the forces exerted on the denture more evenly across the underlying tissues.

Alternative idea to improve the retention in maxillary complete denture is the undercut area (as shows in Figure 5. The shape and depth of the undercut enhance the mechanical retention of the denture and prevent it from dislodging during normal oral functions such as speaking and eating [29]. The undercut area helps the denture withstand horizontal forces that may occur during mastication. Additionally, the presence of an undercut region offers additional support to the denture by creating a larger surface area for contact with the underlying tissues [30]. This support helps distribute the occlusal forces more evenly and reducing stress on the remaining oral structures to enhance the overall stability of the denture [31]. Overextended borders or inadequate relief in the undercut area can cause tissue irritation, discomfort and compromised fit. Therefore, the design and management of undercuts should be carefully evaluated by a dental professional during denture fabrication to ensure optimal stability and patient comfort [30].

In this study, the patient has a large undercut area in the labial region. It was found that the undercut area can increase the retention and stability of the maxillary denture; however, this is not the case for all patients. Sometimes, the undercut can cause pain in the patient's gingiva, and they may not accept it. This finding is in agreement with [31, 32], who stated that the resorption process in the alveolar ridge can cause changes in its size and shape, leading to changes in the undercut area.



(a) **(b)**

Figure 4. a): Maxillary denture included the retention by the posterior palatal seal area; b): Maxillary denture included the retention by spacer

Figure 5. Maxillary denture included the retention by undercut

CONCLUSION

Overall, the findings suggest that incorporating the posterior palatal seal area, spacer and undercut area into complete dentures can effectively enhance their retention, thereby improving oral function, speech, mastication, and overall comfort for denture wearers. However, each of these components plays a role in enhancing the fit and retention of a removable complete denture. But, the use of the undercut technique may not be as effective in achieving optimal denture retention, as indicated by the patient's dissatisfaction.

Recommendations

There are many ways to improve the retention and stability of upper complete denture. Such as, try another design of spacer or relief and comparing between them. Also, study the different between the types of posterior palatal seal area and the effect of each one on the retention of the upper complete denture.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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تحسين الاحتفاظ بالأسنان الفكية الكاملة: تقرير حالة

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المستخلص

تلعب أطقم الأسنان الكاملة دورًا أساسيًا في استعادة وظيفة الفم وتحسين نوعية الحياة للأفراد الذين فقدوا جميع أسنانهم الطبيعية. أحد العوامل الرئيسية التي تحدد نجاح أطقم الأسنان الكاملة هو الاحتفاظ بها، وهو ما يشير إلى قدرة أطقم الأسنان على البقاء بشكل آمن في مكانها أثناء وظيفة الفم الطبيعية. يعد الاحتفاظ الكافي ضروريًا للكلام السليم والمضغ والراحة العامة لمرتدي طقم الأسنان. هدفت الدراسة إلى تحسين الاحتفاظ بأطقم الأسنان الكاملة من خلال ثلاث طرق مختلفة: المباعد، منطقة الختم الحنكي الخلفي، والمنطقة السفلية. تم تصنيع ثلاثة أطقم أسنان باستخدام نفس الخطوات، مع وجود اختلافات في خطوات معينة بناءً على تقنية الاحتفاظ المستخدمة. أظهرت الدراسة أن أطقم الأسنان الثلاثة جميعها قد حسنت الاحتفاظ مقارنة بأطقم الأسنان الكاملة القياسية. أظهرت أطقم الأسنان التي شملت منطقة الختم الحنكي الخلفي والمباعد احتفاظًا أعلى من طقم الأسنان الذي استخدم تقنية التقويض. ومن الجدير بالذكر أن المريض لم يجد طقم الأسنان بتقنية التقطيع بشكل مرضي.

الكلمات الرئيسية. طقم أسنان كامل، منطقة تقويض، إغاثة، فاصل، منطقة الختم الحنكي الخلفي.