AL-AZHAR
Assiut Dental Journal

The Official Publication of The Faculty of Dental Medicine, Al-Azhar Assiut University, Egypt

AADJ, Vol. 5, No. 2, October (2022) — PP. 149:155

ISSN 2682-2822

Comparing Masticatory Efficiency of Implant Supported Overdenture With Two Different Denture Base Materials

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Codex : 02/2022/10

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KEYWORDS

Masticatory efficiency, Denture base, Implant overdenture, Edentulous patients, chewing numbers

ABSTRACT

Aim: This clinical study was conducted to evaluate the effect of using different denture base material on masticatory efficiency in implant supported complete mandibular overdenture. **Subjects and methods**: Twelve completely edentulous patients were selected for this study according to inclusion and exclusion criteria that affect implant success or masticatory system. History taking, clinical, and radiographic evaluation were done for each patient. Preoperative cone beam computerized tomography (CBCT) was done for each to determine bone height and width. Each patient received two implants in the inter-foraminal area of mandible, three months later lower denture was converted into mandibular overdenture. Patients were grouped in two groups Group I: patients were received a complete mandibular overdenture constructed of conventional heat cured acrylic resin denture base. Group II: patients were received a complete mandibular overdenture constructed of flexible denture base material (polyamide). Evaluation of masticatory efficiency were done for each group by calculating chewing numbers and times. All evaluations were done at the time of implant placement, three months, six months, twelve, eighteen and twenty-four months of implant placement. One-way ANOVA with post hoc turkey test was used for multiple time comparison. **Results:** The chewing number and times was non-significant between the two groups. **Conclusion:** The denture base has no effect on masticatory efficiency of mandibular implant supported overdentures.

INTRODUCTION

In the past, various material such as bone, wood, ivory, vulcanized rubbers poly vinyl chloride, vinyl acetate, modifications of bakelite and cellulose plastics were utilized to fabricate complete dentures. But since several years ago polymethylmethacrylates became the most commonly used denture base material[1]. Many approaches have been proposed to strengthen the acrylic resin prosthesis including modifying or reinforcing the resin with different material. Many of these attempts were failed and adversely affect properties of the acrylic resin, so that

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introduction of new material with new properties become necessary to overcome such problem[2]. Thermoplastic resins was consideredas the most recently developed material in the science and art of complete denture prosthodontics, their applications have continued to grow, and used for a broad variety of applications[3-5]. Nowadays the thermoplastic resin can be used as denture base material. [6-8]

The implant supported mandibular overdenture has been the most popular option for treating edentulous mandible, since it allows fixation of the prosthesis to the edentulous ridge which in turn improves function, esthetics, and individual satisfaction[4]. As one of the most important functions of masticatory system is to break down the food into pieces, to mix it with saliva and to prepare it for swallowing. From the dental and medical point of view it is important to be able to determine how well this function can be performed[5]. Enhancing retention and stability of the prosthesis considered as an important factor that affect masticatory efficiency[6]. Therefore this study was carried out to evaluate the effect of using different denture base mandibular implant overdenture in masticatory efficiency.

MATERIALS AND METHODS

A: Patient selection

Twelve completely edentulous patients were selected from the clinic of removable prosthodontic department, Faculty of Dental Medicine Al Azhar University. All patients were selected according to the following inclusion criteria:Men patient aged between 50-60years,class I jaw relationship, patients with enough bone height and width of to permit implant placement without need to other procedures, patients with normal tongue size and behavior, patient with ability to understand instructions and patient with adequate inter-arch space at least 10mm.

The exclusion criteria was: patients with local and systemic diseases that interfere with implant placement and osseointegration, patients with history of drug therapy, immune compromised patients, patients with current chemotherapy or radiotherapy, patients with abnormal jaw relationship, patients with parafunctional habits, and patients with TMJ disorders and Inadequate inter arch space. Each patient received a written consent explaining the study description.Cone beam computed tomography (CBCT) was made for each patient guided by radiographic stent before implant insertion for accurate determination of height and width of bone and size of the proposed implant at specific site or sites. Patients were grouped in two groups.

Group I: patients were received a complete mandibular overdentureconstructed of conventional heat cured acrylic resin denture base

Group II: patients were received a complete mandibular overdentureconstructed of flexible denture base material (polyamide)

B: Surgical phase:

Conventional complete denture was constructed with heat cured acrylic resin for Group I and from flexible denture base for Group II. After finishing of denture adjustment,the surgical procedures of implant insertion were done by two-stage technique. A mucoperiosteal flap was reflected exposing the mandibular alveolar ridge at anterior region the site of implant insertion. After drilling of implant site beginning with pilot drill and subsequent drills to widen the implant site with aid of surgical guide stent. The implants (Dentist, South Korea. 14 mm x Ø 3.7 mm) were derived in position. All patients received screw shaped, root form implant to permit primary fixation between implant and the bone during initial healing period, also, increasing area of contact between implant surface and surrounding bone, the implants were inserted at the canine regions.

Antibiotic (amoxicillin 875mg with clavulanic acid 125mg, and metronidazole 500mg) were taken twice daily for at least 7 days and analgesic (diclofenac sodium 75mg) were prescribed for all patients after surgery. The patients were not allowed wearing their dentures for two weeks after surgery then the dentures were relieved at the implant areas to be seated properly in the patient's mouth.

C: Prosthetic phase:

After three months of surgery and assuring of complete implant bone osseointegration. Second stage surgery was carried out. Exposure of fixture was done, and conventional complete dentures were converted to mandibular overdentures with ball and socket attachment by direct pick up technique by using auto-polymerized acrylic resin. The finished mandibular implant supported over dentures were inserted into patient's mouth and checked for retention and occlusion, final adjustments were made, and the patients were instructed to care and use his or her maxillary complete denture and implant supported mandibular prosthesis for 3 months.

D: Masticatory efficiency test:

By the number of strokes, the masticatory efficiency was evaluated when the patient eating three types of food differ in the degree of their hardness (carrot, banana and apple) and cut in to standardized pieces (1cm x 1cm).Then the patients were set in an upright position and instructed to wear their mandibular overdenture; patient's assurance was done to reach with them to a relaxed unstrained statue and then asked to eat.The following measures were recorded:

a. The number of chewing strokes up to the first swallows.
b. The number of chewing strokes till the mouth will be free of food.
c. The number of swallows until the mouth will be free of food.
d. The time (in seconds) until the mouth will be free of food.

The clinical observations were done at different intervals (time of insertion, three months, six months, twelve, eighteen and twenty-four months). Except The masticatory efficiency was evaluated after two months of implant placement.

Statistical Analysis

Numerical data were explored for normality by checking the distribution of data and using Kolmogorov Smirnov test of normality. Data showed normal (parametric) distribution. Data were presented as mean and standard deviation (SD) values. Independent t-testwas used to compare masticatory efficiency between two groups. The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM SPSS© Statistics Version 20 for Windows.

RESULTS

The mean data of chewing strokes is presented in (Table 1, and Figure 1). For chewing time, the data is shown in (Table 2, and Figure 1). The flexible denture wearer had the lowest number of chewing strokes, the shortest mastication times during chewing of the different food types, and the least number of swallowing compared with acrylic denture wearer.However,the difference between the two test groups were statistically non-significant ($p<0.05$).

Table (1) *The mean values of number of chewing cycle between test groups. $p \leq 0.05$*

	Till the first swallow				Till mouth was free of food			
Food	Group I	Group II	p value*	Sig	Group I	Group II	p value*	Sig
Carrot	19	18.25	0.64	Non-Significant	22.75	21.25	0.34	Non-Significant
Apple	15.75	15.25	0.62	Non-Significant	20,5	18.75	0.38	Non-Significant
Banana	13	13.5	0.58	Non-Significant	17.5	18.75	0.35	Non-Significant

**Independent t-test*

Table (2)*The mean values of chewing times (in seconds) between test groups. $p \leq 0.05$*

	Till the first swallow				**Till mouth was free of food**			
Food	**Group I**	**Group II**	**p value**	**Sig**	**Group I**	**Group II**	**p value**	**Sig**
Carrot	**8.5**	**8**	**0.65**	**Non-Significant**	**28**	**26.75**	**0.50**	**Non-Significant**
Apple	**6.5**	**5.5**	**0.20**	**Non-Significant**	**23**	**21.75**	**0.53**	**Non-Significant**
Banana	**4.5**	**4.25**	**0.67**	**Non-Significant**	**21.25**	**20**	**0.56**	**Non-Significant**

**Independnet t-test*

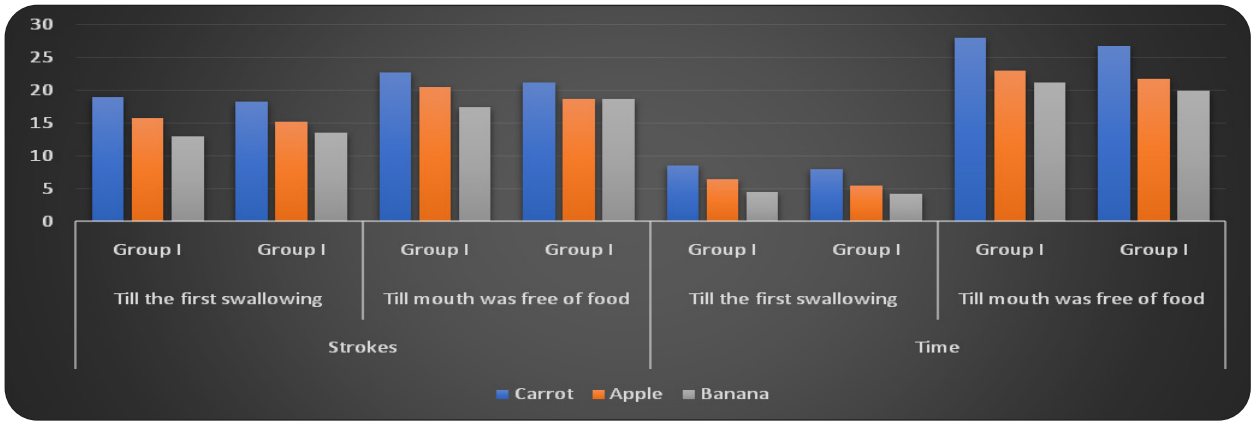

Fig. (1) The mean strokes and times of different foods for each group

DISCUSSION

Despite recent advances in preventive dentistry that helps in protecting the natural teeth , Edentulism has been still and remain the main problem facing developing countries that result in a rapid increase in their elderly population[12] . Tooth loss has a profound impact effect on the lives of people. Emotionally tooth loss effect can range from bereavement, lowered self-confidence, altered self-image, dislike of appearance[13]. When considering prosthetic rehabilitation of the edentulous mandible with implant-supported or retained overdenture, various parameters may affect the chosen treatment plan, such as residual ridge resorption, the patient's expectations, medical condition, skills, and financial capabilities all of these should be considered for success of treatment regardless number of implant or abutment type .[14] . Several materials from the past to date were used for complete construction but Poly (methylmethacrylate) is still the most predominantly used denture base material because

of its excellent esthetics, ease of processing and repair and being economical. However, this material is not ideal in every respect due to its liability to break during function.[15]. Thermoplastic resins have many advantages over the conventional polymethylemethacrylate, because they provide excellent esthetics with tooth or tissue colored materials and are very comfortable for the patient. These are very stable, resist thermal polymer unzipping, have high fatigue endurance, high creep resistance, excellent wear characteristics and solvent resistance. They are non-porous so no growth of bacteria, and even if it is non-porous, it still retains a slight amount of moisture to keep it comfortable against gums. They may also be relined and repaired by repressing the restoration.[16].

The masticatory test done in this study was according to khamis et al [17]. Masticatory ability is a measure and a perception of how well subjects think they break down foods. The measurement method of this study was based on the number of masticatory cycles which is the most common and powerful , since it reveal the distribution of food chewed in the number of cycles[18]. This finding was in agreement with study that was conducted to estimate and compare masticatory efficiency in patient wearing heat cured acrylic and flexible partial denture, and resulted in The flexible partial denture provide better chewing efficiency than heat cure acrylic partial denture, the masticatory performance was higher for flexible partial denture than heat cure acrylic partialdenture.[19]. And it in disagreement with the study that was conducted to evaluate and compare differences in masticatory efficiency of patients treated with complete dentures made with either high impact or flexible resins, and concluded that masticatory efficiency and performance were found to be better for patient's dentures made with Polymethyl methacrylate (PMMA) than flexible resins.[20]. Possible explanation of the result may be related to flexibility of the denture that may be reducing pain associated with function that will improve performance of the denture.

CONCLUSIONS

The masticatory efficiency did not show any statistically significant different between acrylic and polyamide denture base in mandibular implant supported overdenture

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AADJ, Vol. 5, No. 2, October (2022) — PP. 155

مقارنة كفاءة المضغ لاطقم الاسنان المدعومه على غرسات المصنعتيين من مادتين مختلفتين

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الملخص :

الهدف: أجريت هذه الدراسة سريريا لتقييم مدى تأثير مادة قاعدة الطقم على كفاءة المضغ لأطقم الأسنان السفلية الكامله المدعومه على غرسات.

المواد والاساليب: أجريت هذه الدراسة سريريا لتقييم مدى تأثير مادة قاعدة الطقم على كفاءة المضغ لأطقم الأسنان السفلية الكاملة المدعومه على غرسات لاثنا عشر مريضا من المرضى المترددين على عيادة الاستعاضة الصناعية المتحركة بكلية طب الأسنان جامعة الأزهر بنين القاهرة.بعد التأكد من خلوهم من الأمراض العضوية او بالفم التي تعيق اجراء الدراسة.لذا قد تم أخذ التاريخ المرضي لكل مريض على حده اضافة الى الفحوصات اللازمه للفم داخليا وخارجيا سريريا واشعاعيا عن طريق الاشعة المخروطيه لتقيم طول العظم قبل وضع الغرسات. تم وضع غرستين اثنتين لكل مريض في المنطقة الأماميةلثقبي الذقن ثم بعد ذلك تم تحويل الطقم السفلى الكامل العادي الى طقم فوقى مدعوما بالغرسات بعد ثلاثة شهور من وضع الغرسات. ثم قسمت المرضى الى مجموعتتين ,المجموعة الاولى ذو الطقم المصنع من الاكريل العادى بينما المجموعة الثانية العطيت الطقم المصنع من المادة المرنه ,بعد ذلك قيست كفاءة المضغ لكلتا المجموعتتين كلا على حده غن طريق حساب عدد المضغات والوقت اثناءوضع الغرسات ثم بعد ذلك خلال فترة ثلاثة أشهر. ستة أشهر. اثنا عشرة شهرا. ثماني عشرة شهرا. أربع وعشرون شهرا من وضع الغرسات . ثم تم جدولة النتائج وتحليها احصائيا عن طريق اختبار (أنوفا) أحادي الاتجاه. وبناء عليه اظهرت النتائج عدم وجود تغير معنوي احصائى لكلتا المجموعتتين خلال فترة المقارنة.

النتائج: لا يوجد اى فروق احصائيه فى عدد وكفأة المضغ بين المجموعتين.

الخلاصة: ليس هناك دور لمادة قاعدة الطقم المدعومه على غرسات على كفاءة المضغ

الكلمات المفتاحية: كفاءة المضغ ,قاعدة الطقم الطقم المدعومه على غرسات , المرضى عديمى الاسنان, مرات المضغ