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Original Research Article

Clinical Evaluation of Maximum Bite Force in Patient with Heat Cure acrylic and Flexible Partial Dentures

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Abstract

To measure the MBFs to PMMA & flexible base partial dentures in the people who have free end extension over various periods of adaptation.

Thirty free end extension people have been choose and they with: a Cl. I, (36-45) years & means 40 years of age. Fifteen with upper or lower Cl.I without mode area whereas the residual fifteen people with Cl.I opposite Cl.I . The MBF measured at 1st molars area by occlusal force gauge. Then, recording done (at 1st, 10th, 30th, 90th day) from the flexible removable prosthesis insertion primarily then the acrylic prosthesis.

Biggest mean value of MBF was listed in first group at 90th days after insertion flexible removable prosthesis (105.58330 N), and as a whole, flexible removable prosthesis giving the biggest biting forces in both group than acrylic prosthesis and the differences were significant at ($p<0.05$) between them in the MBF .The persons in group one give biggest biting forces in all periods of adaptation when wear flexible removable prosthesis than acrylic prosthesis, and it will increased with increased period of adaptation, with the least biting forces at 1st days & the biggest at 90th days in the two study group.

The conclusion. MBF of person wear removable prosthesis flexible base type was greater from that wear acrylic type , period of adaptation when increase, the bite force become greater. The person wear one prosthesis opposite normal dentitions give MBF greater than the person wearing a two prosthesis upper against lower [Kennedy classification Cl. I opposite Cl. I] .

Key Word: Clinical, evaluation, bite, force, patient, denture, heat cure, acrylic.

التقييم السريري لقوة العضة العظمى للمرضى ذوي أطقم الاكريلك والاطقم المرنة

الخلاصة

الهدف من هذه الدراسة هو قياس وتقييم قوة العضة العظمى بطقم ذو قاعدة من الاكريليك و طقم ذو قاعدة مرنة من الأطقم الجزئية للمريض الذي لديه فقدان الاسنان الخلفية وخلال فترات مختلفة من التكيف.

الطريقة: لقد تم اختيار ثلاثين مريضا من المرضى الذين لديهم فقدان الاسنان الخلفية الذين يراجعون عيادة صناعة الاسنان ، في جامعة بابل / كلية طب الأسنان، والمرضى شاركوا طوعا، وهم: من النمط الاول الهيكل العظمي من (Cl.I) ، (٣٥–٤٥) سنة، بمعدل ٤٠ سنة من العمر، وخمسة عشر منهم تم اختيارهم مع الفك العلوي أو الفك السفلي (Cl.I) دون أي شكوى من الألم في وقت الدراسة، في حين أن المرضى الخمسة عشر المتبقية Cl.I ضدCl.I. النتائج: تم العثور على فروق معنوية في قيم قوة العضة العظمى بين نوعي أطقم الأسنان الجزئية بمتوسط (٣٩,٩٣٧٥ ± ١,٠٤٩٤٩) للطقم ذو قاعدة من الاكريليك و (٧٢,٣٩ ± ٣,٠٧١٩٤) لبدلة مرنة في كل فترة التكيف في المجموعة الأولى، (٢٨,٦٢٥٠ ± ٠,٦٩٠٣٨) لطب الأسنان الاكريليك و (٥١,٧٢٩٢ ± ١,٣٧٩٥٤) للطقم ذو القاعدة المرنة في جميع فترات التكيف في المجموعة الثانية. تم ادراج اكبر قيمة متوسطة لقوة العضة العظمى في المجموعة الاولى بعد ٩٠ يوما بعد ارتداء الطقم ذو القاعدة المرنة (١٠٥,٥٨٣٣ N) وان الطقم ذو القاعدة المرنة تعطي اكبر قوة العضة

في المجموعتين وفي جميع المرضى من الطقم ذو قاعدة من الاكريليك الجزئي والاختلافات بين النوعين الأساسيين للأسنان في قوة العضة العظمى كان معنويا عند ($p<0.05$) في كلتا المجموعتين الدراسيتين، بين مرضى المجموعة الأولى الذين يرتدون الطقم ذو القاعدة المرنة تعطي أكبر قوة لدغة في فترة مختلفة من التكيف من أطقم الأسنان الاكريليك الجزئية، كما زادت قوة العضة العظمى مع زيادة الفترة من التكيف، مع أدنى قوة عضة في الأيام الأولى وأعلى بعد ٩٠ يوما في المجموعتين.

الاستنتاج: كانت قوة العضة العظمى في المريض مع الطقم ذو القاعدة المرنة أكبر من ذلك مع أطقم الأسنان الاكريليك الجزئية، قوة العضة تصبح أكبر مع زيادة فترة التكيف، وأيضا قوة العضة أكبر في المريض مع فك متحرك اصطناعي واحد من قوة العضة للمريض مع أسنان علوية وسفلية اصطناعية.

الكلمات المفتاحية: التقييم السريري, قوة ,العضة, المرضى, الطقم.

Introduction

The esthetics, psychological thought ,phonetics, and functional occlusion of the patients will disturbed by dentition losing, that happened because of diseases of dentition, trauma, or due to pathology [1]. The losing dentitions should be replaced to regain the function and also the defect can be repaired [1]. The frequently materials that can used for the construction of removable denture was the polymethylmethacrylate (PMMA). Despite various advancements and researches in the materials in dentistry, techniques &training, around the world, foul smell, fracture, & the sensitivity to PMMA cannot be prevented. The person, who started, as soon as possible, wearing dentures for multiple reasons, always become depressed and begin seeking somewhat best accessible for him [2].

Even though, the removable denture which made from metal considered as an alternative, but it need sensitive technique casting procedure, the high skill requirement in preparation, heavy weight, &metal clasp visibility make it much harder& the result was discouraging [3].

The modern preference in the denture's materials was the nylon-like material which used to fabricate the removable partial denture. Generally, it was use instead of the metal & acrylic base of partial denture which is conservatively used to o configure the framework for criterion removable dentures (RPD). The flexible denture is almost accepted from the point of esthetic because its color is colored gums, unbreakable, it can be made light, & can made the base of the denture as well as the clasps [4]. Practically it is undifferentiated from the gingiva, because the clasps was made underneath the survey line. The work with this type of dental materials much easier during correcting the denture inside the mouth of the patient, using grinding tools with slow-speed. Also, the insertion maintenance of the post was easy making the materials of the denture a friendly use of the patient [5,6]. This flexible denture based material has an expectable over the long-term, naturally steady and offers resistance to the polymer unzipping. Also, it offers a great resistance to the creep, wear, dissolution and fatigue endurance, do not collect dyes or stain and no porosity. The stress can be prevented from transmission to the rest of the dentition by the material's flexibility, so the forces will disengage from the teeth [7]. Midline denture fractures can be overcame by using flexible denture material [8].

The objective of prosthodontics was restoring the functions of teeth such as mastication &it was essential in achieving patient satisfaction, which requires cutting food to facilitate swallowing & digestion. The effect of insufficient pump on digestion of food and on the health of the body was studied [9]. Greene *et al* [10] had revealed that the incidence of gastrointestinal complaints is high significantly in people with deficient masticatory ability than people sufficient pump capacity. Boccardo and Betancor[11] made advanced research and found that there is a correlation between gastric excretions and gastrointestinal potential. Masticatory efficiency can be evaluated by maximum bite force (MBF).

The MBF on the complete denture is highly less than that created by the person with excellent teeth [12]. A significant correlation was present between MBF and mastication ability state by Fontijn-Tekamp and approximately half of the differences in the mastication ability could be explained only by the bite force [13]. The bite force measurement was generally used to evaluate the efficiency of the artificial prosthesis, [14] as well as, it is used to examine the disorder of digestive system [15]. A suitable transducer can be used to measure the bite force directly by putting it between a pair of dentition [16].

Many factors affect the direct measurements of bite force, such as, precision of bite force scale which related to the recording systems' mechanical features [17]. The usual mode of age progress might causes a weakness of the strength of the muscle [18]. Certainly, the jaw closing force increasing with growth and it remains constant at the middle of age (twenty-forty, fifty year), and after that it will decreases [19]. Shinogaya *et al* [20] have assessed the age's influence on the MBF& the contact areas of occlusion in old people &the young subjects of Japan. The MBF& the contact areas of occlusion have been showed to be greater significantly in senior group than in young group.

Regarding gender, MBF is the highest in male which related to greater potential of the muscle and this might be linked to anatomical variations [18,21-23]. The menmasseter muscles consist of kind two fibers which have bigger width and greater cross section from women's muscles [19,24]. Larger values of bite force have been recorded by Ferrario *et al* [16] in males &the explanation of this result was that their dental size was larger& so it have greater areas of the ligaments of periodontium, which offer a bigger force bite.

The number of the teeth and contact has important affections on the MBF. The bigger force bite in premolar &molar might be dependent to increasing contacts of occlusion of these teeth which loading more when person bite [25]. The number of contact of occlusion was an important determining factor to force bite from dentition's number "stated by Bakke et al" [26]. The force bite have evaluated in the full removable prosthesis, the partial prosthesis & the normal teeth by Lasilla *et al* [27]. His findings close to the findings of Miyaura *et al* [28] "bigger force bite in normal teeth group".

Many apparatus that used to measure the MBF, it differ from each other by its structure some of them simple spring other complicated electronics apparatus. The study of Borelli in 1681 [29] describing the intra-oral force and designed a gnat dynamometer. The first scientific examination of force have been made by Black in 1893, later, many investigators continue to discuss this topic & planned levers-springs, manometers-springs and levers, and micrometered device [29,30]. Nowadays, sensitive electronics apparatus have been applied. This instrument is precise to measure the MBF. Gnato-dynamometer was applied to record the MBF for a long period and strain-gauges mounted dynamo-meter have been used for recordings by some investigators [31,32]. Then a digital dynamometer which compose of fork bite and a digital body was developed [25,33]. Commonly used measuring apparatus was strains-gauge force bite transducers, which is available in different widths and heights [33,34].

Bite force is varying in variant areas of mouth [16]. When the transducer applied in the maximum posterior area of the arch, the highest force bite will obtained and this force can be tolerated well [34]. The mechanical lever system of the jaw was explain it [24,35].

The aim of this study is to measure &evaluate the MBFs to PMMA & flexible base partial dentures in the people who have free end extension over various periods of adaptation.

Materials and Methods

Thirty free end extension people (FEE) have been choose (15 men and 15 women)

presenting clinic of the prosthetics department, at University of Babylon/faculty of dentistry, peoples who voluntary shared and taking complete information about the target of the experiment and they with: a Class I skeletal pattern (Kennedy classification), (36-45) years and means 40 years of age, educated patient and has a good physical ability to follow the instructions.

Fifteen with upper or lower class I (Cl.I) Kennedy without mode area [1st, 2nd and 3rd molar losing dentitions opposite normal teeth] and without any trouble complaining during the experiments' time, whereas the residual fifteen people with Cl.I opposite Cl.I.

The phases of examination are three to each kind of denture base materials , the test was made early following the breakfast.

The program of the experiment contained measuring the MBF at 1st molars are a by usage a portable occlusal force gauge (Figure 1), which composed of a gauge for hydraulics pressures and a bite elements which consist from vinyle materials enclosed with tube from polyethylene. The biting forces were showed numerically (with digital in Newton), and precisian of the device was prove nearly [36], and can easy to use, with small thickness (of about 5.4 mm), no need for any special mounting, &disinfected via altering the disposable plastics covering [37]. The person should site in the upright situation so that Frankfort-plane be parallel to the floor nearly and every person should informed biting hardly on gauge. The measurements of biting forces done with 3trialsand between the trails thirty seconds to rest. Then take the mean from these three trails and record one read only, and then maximum reading gotten which considered MBF. Primarily examine the denture, it should be devoid from spicules or nodules to preventit's affection on our readings.

Later, in the day of insertion of partial removable prosthesis, the measurements done ,at the (10^{th} day), at the (30^{th} day), & lastly at (90^{th} day) from the flexible removable prosthesis insertion primarily then the acrylic prosthesis. The device should site between the artificial first molar and the against normal dentitions (in group one) & against artificial tooth (in group two).

Figure1: Occlusion forces gauge: (GM10, Nagano Keiki, Tokyo, Japan)

Statistical Analysis:

The analysis of the data have been done by using Statistical Package for Social Science version 20 (SPSS Inc.®, Chicago, Illinois, USA). The descriptive data were tabulated. To determine variance and if significant difference occurred between groups, T-test have been used, criterion level for statistical significance was set at ($p<0.05$) (two-tailed), and the data are represented as "mean ± standard deviation (SD).

Results

(Table-1) presented persons who participating in the study, distribution of gender, age range, and case of dental arch. (Table 2) presented a biggest mean value of MBF was listed in first group at 90^{th} days after insertion flexible removable prosthesis (105.58330 N), and as a whole, flexible removable prosthesis giving the biggest biting forces in both group than acrylic removable prosthesis [Figure-2] and the differences were significant at ($p<0.05$) between them in the MBF.

(Table-2) display that persons with upper or lower Cl.I without mode opposite normal teeth(group one)give biggest biting forces in all periods of adaptation when wear flexible removable prosthesis (at the insertion time,10^{th} day, 30^{th} day, & lastly at 90^{th} day) than acrylic removable prosthesis, and it will increased with increased period of adaptation, with the least biting forces at 1^{st}days & the biggest at 90^{th} days in the two study group. Tables (4 & 5) demonstrate the biggest MBF values in the first group in all period of adaptation and with both partial denture, and the differences in MBF is significant at ($p < 0.05$), between the study group.

Discussion

The bite force was higher for the flex. removable prosthesis for the two group and in all patients than that for the acrylic base partial denture, figure-2 and in both group, the differences in MBF is significant at ($p<0.05$) between the two partial denture base types, the possible reason to these results was because the flex. removable prosthesis has elasticity to release force from the abutment and inhibitit's transmission of force to the residual normal dentitions and opposite sides since works as stress breaker. So the base's material properties will control the forces applied on the denture rather than the design characters. The flexible lever not work well as a lever. So we will reduce leverage effects of flexible partial denture extensions, because lever was effective when synthetic from a solid material [16].

This study show that the MBF was significantly increased with increasing in the periods of adaptation and bite force measurement was positively related to the masticatory efficiency [35,41,42]. Fontijn-Tekamp [13] found a significant correlation between MBF and chewing efficiency & approximately half of variations in mastication ability were clarified by the biting forces only. Thus, this research result not only corresponded to Miyaura [28], Hayakawa [41], and Murata [40], but also agree with Aung *et al* [42], Zainab [43,44] studies who found the greatest bite force will obtained with removable prosthesis after the adaptation.

The greatest MBF readings in the first group in the whole period of adaptation & in the two types of removable prosthesis, the possible reason for this result that there is single prosthesis (Cl.I opposite normal dentitions), thus occlusion forces guage was placed between denture and normal dentitions, so the biting forces will effected by the physiology of the body such as biting forces and oral proprioceptive of normal dentitions [45], biting force is the highest in normal dentition, so food breakage best& so best the mastication ability.[13]

Conclusions

MBF of person wear removable prosthesis flexible base type was greater from that wear removable prosthesis acrylic base type , period of adaptation when increase, the bite force become greater. The person wear one removable prosthesis only upper or lower [Kennedy classification Cl. I opposite normal dentitions] give MBF greater than the person wearing a two removable prosthesis upper against lower [Kennedy classification Cl. I opposite Cl. I].

Table 1: The data of research groups

The number	The Gender		Age	The case
15	Man 7	woman 8	36-45	Cl. I opposite natural teeth (group 1).
15	Man 7	woman 8	36-45	Cl. I against Cl. I (group 2).

Table 2: Comparison of mean and SD of MBF represented with Newton between 2 types of materials' base in various period of adaptation in group (1)

Adaptation period(days)	Base materials' type	MBF mean(N)	MBF sd.	Mean Differences
At the first day	PMMA	32.1657	2.22900	-20.1500
	Flex.	52.3167	3.52963	
After ten days	PMMA	36.1500	3.83057	-21.6500
	Flex.	58.1000	5.04525	
After one month	PMMA	41.2333	2.74138	-32.1500
	Flex.	73.4833	3.86201	
After three months	PMMA	50.1000	2.11565	-55.45833
	Flex.	105.58330	4.144180	

Table 3: Comparison of the mean and SD for MBF between two types of base's materials in different periods of adaptation in group 2

Adapt. period(day)	Base materials' type	MBF mean(N)	Standard deviation	The Mean Differences
At the first day	PMMA	22.4833	1.92855	-18.06667
	Flex.	41.1500	2.56185	
After ten days	PMMA	26.6500	1.81524	-19.50000
	Flex.	46.1500	3.27862	
After one month	PMMA	30.0733	1.31237	-24.04167
	Flex.	54.5100	3.87398	
After three months	PMMA	34.6767	1.61333	-30.21500
	Flex.	64.9267	2.71121	

Table 4: Comparison of mean and SD for MBF between 2 group in a different period of adaptation wearing PMMA removable prosthesis

Adapt. period(day)	Groups	The Mean(N)	Standard deviation	The Mean Differences
At the first day	Gr. 1	32.1567	2.329000	9.58433
	Gr. 2	22.5733	1.92265	
After ten days	Gr. 1	36.2600	3.83057	9.500000
	Gr. 2	26.7600	1.81434	
After one month	Gr. 1	41.3433	2.73138	11.150000
	Gr. 2	30.0823	1.21137	
After three months	Gr. 1	50.1000	2.11565	15.23333
	Gr. 2	34.6667	1.71433	

Table 5: Comparison of mean and SD of MBF between two groups in a various period of adaptation with the flexible partial denture:

Adapt. period(day)	The Group	The Mean	Standard deviation	The Mean Differences
At the first day	Gr. 1	51.4167	3.42963	11.06667
	Gr. 2	41.1500	2.56185	
After ten days	Gr. 1	58.1000	5.03525	11.76000
	Gr. 2	46.1500	3.28872	
After one month	Gr. 1	73.4833	3.88201	19.08233
	Gr. 2	54.4000	3.88298	
After three months	Gr. 1	105.5333	4.13418	40.666667
	Gr. 2	64.9177	2.70221	

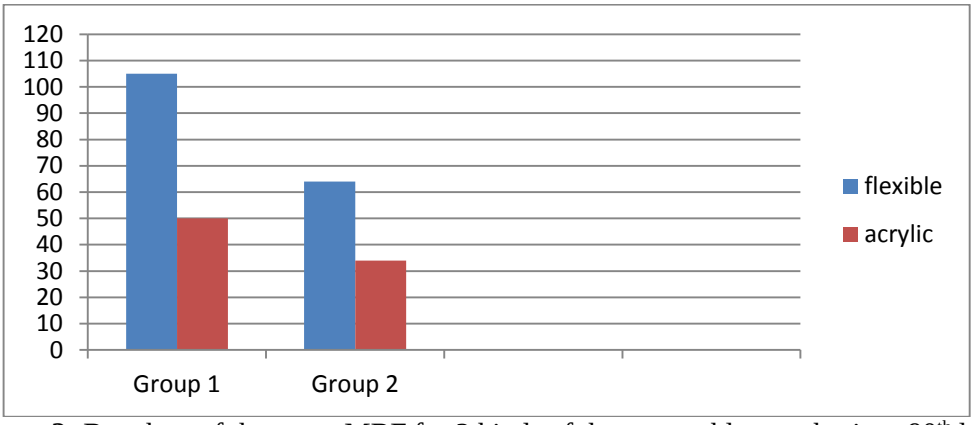

Figure 2: Bar chart of the mean MBF for 2 kinds of the removable prosthesis at 90thdays.

Symbols

cl.I Class I Kennedy classification: bilateral free end extension
N Newton
SD Standard deviation
SE Standard error
MBF Maximum bite force
Flex. Flexible

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