

Comparative Evaluation of Two Techniques in Achieving Balanced Occlusion in Complete Dentures

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Abstract

Background: This study was undertaken to evaluate new technique, which claims to reduce treatment time while retaining the quality of treatment. The aim of this study was to compare complete dentures made by two techniques: with the use of face bow and without the use of face bow.

Methods: Twenty edentulous subjects were selected and each one received two pairs of complete dentures. Dentures were made from duplicated casts and each one followed different techniques. One technique used face-bow. Teeth were set using individualized wax rims as guides. In other technique an articulator was used, which avoids face-bow and teeth were set by the cast-analysis method. The number of occlusal contacts in centric relation and excursive movements were registered, in addition to this the opinion of patients regarding denture bearing during oral functions were taken.

Result: Both groups had dentures with balanced occlusion, but the technique that avoids face-bow presented better results in regard to time taken, esthetics, comfort and stability. Balanced occlusion was provided even without face-bow and could be an alternative to obtain adequate complete dentures with a better prognosis.

Conclusion: For achieving better quality of denture in the form of esthetics, phonetics and function in short duration of time; a new technique was used to establish balanced occlusion in complete denture prostheses.

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Key Words : Complete dentures; Articulators; Occlusion

Introduction

Occlusion is a factor that is common to all branches of dentistry. It is a term generally accepted to describe the contact relationship of the upper and lower teeth [1]. Occlusion is defined as the static relationship between incising and masticating surfaces of the maxillary and mandibular teeth. There are numerous concepts, techniques, and philosophies concerning complete denture occlusion. There has been a perplexing lack of concern regarding concepts, principles, theories and methods of evaluating and understanding the masticatory system. There are many kinds of occlusion which are significant in complete prosthodontics. Balanced occlusion refers to the occlusion with simultaneous contacts of the occlusal surfaces of the teeth on both sides of the arch, regardless of the mandibular position.

“A phrase was coined in the mid '60s to explain the movements of dentures that occurred irrespective of the occlusal scheme used, which stated “enter bolus, exit balance” [2]. In an artificial dentition, with denture bases only really being controlled by muscle activities (albeit to varying degrees), it becomes imperative that balancing contacts occur as soon as possible into, around,

and out of centric occlusion, so as to minimize any movement of the denture bases. Centric occlusion is the most frequently used position during mastication but also during swallowing, an action that occurs about 1500 times in 24 hours, and so any slide into centric occlusion, the position adopted during swallowing, should be balanced to minimize denture movement and undue forces being exerted on the base. Other actions also take place that can jeopardize even the most ideal arrangement of artificial teeth and denture bases. The occlusal scheme for complete dentures should be one in which there are as many contacts around the arch as possible at all excursive movements away from, and back into, centric occlusion.

One of the most important requirements for successful complete dentures is a balanced articulation. An adequate occlusal scheme allows better distribution of masticatory forces, improves denture efficiency and stability. In order to achieve this, it is necessary to reproduce centric relation and use an adequate articulator [3]. Articulators reproduce patient characteristics with more accuracy [4,5]. However, fully adjustable articulators are not practical, since they present high cost, demand knowledge on equipment and

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long chair side time. On the other hand, nonadjustable articulators are easy to handle, but fail to obtain a balanced occlusion and dentist spends much time on occlusal adjustments [6,7]. Considering the aforementioned statements, semi adjustable articulators seem to present the most adequate effectiveness/handling relation for complete dentures. These articulators are easy to handle and allow a full balanced occlusion during mandibular excursions, comprising individual characteristics of each patient. Face-bow is widely used to transfer the patient's occlusal plane inclination to the semi adjustable articulators. In the same manner, individual compensating curves, following patient path angles for mandibular movements are established. However, using face bow and establishing compensatory curves could be troublesome in cases of elderly and ill patients. Although the use of a face bow presents many theoretical advantages, they not necessarily produce better clinical results. The information given in this paper might save time, and thereby allow prosthodontists and general dental officers in armed forces to rehabilitate and restore a large number of patients. It would also help in a better understanding of the dynamics of complete denture prostheses and thus improve treatment and training in this institution.

Material and Methods

In this study two different techniques of complete dentures construction were compared. The first used face-bow and a semi-adjustable articulator, Hanau H2 (Hanau Eng. CO. Buffalo USA). The second used a semi-adjustable articulator (Stratos 100, Ivoclar, Liechtenstein), which avoids the use of face-bow, using an average mounting based upon patient's casts analysis. Therefore, there is a constant endeavor to explore newer techniques that would simplify procedures and save time.

Completely edentulous subjects with well formed ridges with class I jaw relation were selected for this study. Twenty such subjects were restored with two sets of complete dentures, fabricated by each of the two techniques undervaluation. After initial examination and the impression procedures the functional casts so obtained were duplicated with silicone. Casts obtained were separated into two groups which were mounted on two different types of semi adjustable articulators. Casts in technique I were mounted using a face bow in a Hanau H2 articulator (Hanau Eng. CO. Buffalo, USA). Casts in technique II were mounted without face bow record in a Stratos 100 articulator, (Ivoclar, Liechtenstein). Following articulation, teeth setting was carried out using the same types of teeth set (Ivostar-Gnathostar, Ivoclar, Liechtenstein). There after all the dentures were processed in conventional manner.

Technique I

The upper cast was mounted by face bow technique, (Fig. 1). Lower casts were then aligned and fixed to the articulator

in centric relation position. Horizontal and lateral condylar guidance was individualised by following the individual centric and protrusive relation records. The teeth setting was carried out and occlusion was corrected by means of fine gritty stones to obtain a balanced articulation in protrusive and lateral mandibular excursions (Fig. 2).

Technique II

Here the casts were mounted on the articulators based on average values. This technique was specific to this type of articulator and was developed to avoid the use of face bow. The lower cast was fixed to the lower part of the arcon type of articulator by means of a horizontal guide appliance (Fig. 3), specific to this instrument, which determine the arbitrary occlusal plane utilizing the patient's retro molar pad and labial frenum, for reference, as it appeared on the cast. Once the lower cast was fixed to the articulator with the plaster, the rims in centric relation were placed over the lower cast. This allowed the positioning of the upper cast which was fixed with plaster. Teeth setting in this technique was carried out as per the method of Bio functional Prosthetic System (Ivoclar, Liechtenstein) with the help of a two dimensional template (Fig. 4). The technique described by the manufacturer uses cast analysis, as well as the relation between dental arches and anatomic criteria, like palate, retro molar pad, rugae on palate and maxillary tuberosities. These procedures were performed observing adequate overbite, and to obtained balanced occlusion (Fig. 5).

The same operator carried out all procedures. The time taken in carrying out various procedures that were not common to the two techniques was noted. After fabrication, each pair of dentures was tried in patient's mouth. Occlusal contacts of each pair were registered with articulating paper, individually and a record was kept. The patient was supplied with one pair of dentures for 10 days before he/she was recalled to answer a questionnaire. There after the other pair was inserted and patient was asked to answer the questionnaire after another 10 days. The results concerning the number of contacts achieved by each technique and questionnaire were statistically analyzed by Test of Proportion analysis and Wilcoxon Test.

Results

In technique II, face bow recording, mounting on the articulator in that particular position, gothic arch tracing, recording of centric and protrusive check records and programming of Hanau H2 articulator were avoided. Hence time taken in fabrication of complete denture with balanced occlusion in technique II was very less as compare to technique I.

At denture delivery appointment, only one pair of denture was given to the patient. Occlusal contacts were registered with articulating paper. They were counted at the upper denture, confirmed at the lower denture and signed. To minimize errors, contacts were done twice in each person, in a total of 20 samples. Patients were instructed to return after 10 days and then answered the Group A part of an appropriate questionnaire (Annexure 1). The second pair of dentures were

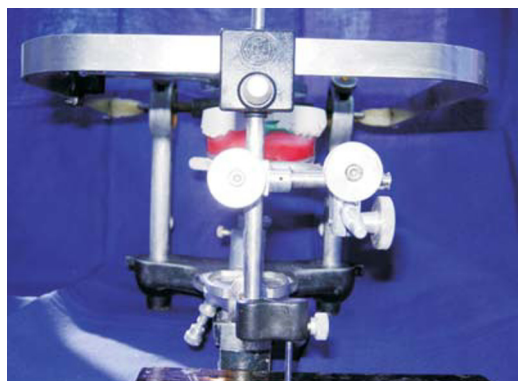


Fig. 1 : Cast mounted in the Hanau articulator with face-bow (Group A).



Fig. 2 : Teeth mounting concluded in the Hanau articulator.

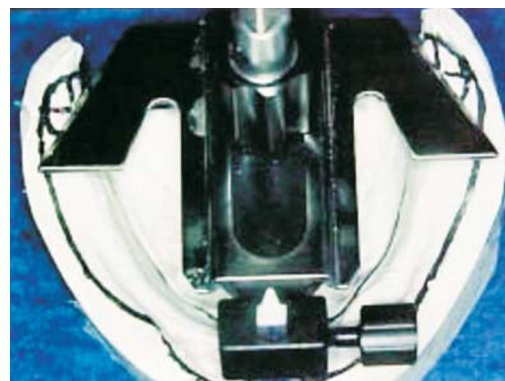


Fig. 3 : Horizontal guide of the Stratos 100 articulator positioned over the lower cast.



Fig. 4 : Horizontal guide is repositioned to the upper part of Stratos 100 and position the posterior lower teeth



Fig. 5 : Teeth mounting at Stratos 100 articulator

then delivered and procedures were repeated. After wearing period, patients were asked to choose one of those pairs, which were also signed. Results concerning about questionnaire and number of contacts of groups A and B were statistically analyzed by the Test of Proportion analysis and Wilcoxon Test with a significance level of 6%. To access differences between the groups about these criteria, Wilcoxon Test was used to verify occlusal contacts and Test of Proportion Analysis was made for questionnaire answers.

Occlusal contacts presented a statistically significant difference between the average of Groups A and B for centric relation ($p=0.005$) and left lateral movement ($p=0.010$), in which group B presented the greater number of contacts. At right lateral movement there was a tendency of group B to present higher number of contacts ($p=0.065$), due to the proximity of p-value established of 6%. There was no statistically significant difference between groups of dentures ($p=0.331$) for protrusive movements (Table 1). Lateral movements were subdivided into working and non-working sides or the balancing side, whereas protrusive movements were separated in anterior and posterior contacts. Concerning working side at lateral movements, dentures in group A presented worse results than dentures in group B, at right lateral movements ($p=0.007$), but at left lateral movement, there was no statistically significant difference ($p=0.102$) as shown in Table 2. A different situation was found in the non-working side or the balancing side, in which Group A obtained worse results at left lateral movement ($p=0.023$), No statistically significant differences were observed for right lateral

Annexure 1

Questionnaire about complete denture bearing

Name of the Patient: Date:

Evaluation of Group A dentures made by using technique I

- 1. Comfort during wearing period:
 Bad Satisfactory Very Good
- 2. Stability:
 Bad Satisfactory Very Good
- 3. Bearing during speaking:
 Bad Satisfactory Very Good
- 4. Bearing during chewing:
 Bad Satisfactory Very Good

Evaluation of Group B dentures made by using technique II

Date :

- 1. Comfort during wearing period:
 Bad Satisfactory Very Good
- 2. Stability:
 Bad Satisfactory Very Good
- 3. Bearing during speaking:
 Bad Satisfactory Very Good
- 4. Bearing during chewing:
 Bad Satisfactory Very Good

Preference: Denture A Denture B

Patient's signature:

movement ($p=0.233$) in relation to group B (Table 3). Regarding protrusive movement (Table 4), there was no statistically significant difference between denture groups both for anterior ($p=0.725$) and posterior contacts ($p=0.373$). Considering all movements analyzed, dentures from group B, on average, obtained greater number of occlusal contacts than dentures from group A. According to questionnaire, it was observed that denture B had better acceptance by patients, due to the answers "Bad" ($p=0.17$) and "Very Good" ($p=0.057$) there was a statistically significant difference between groups A and B (Table 5). After the analysis, it could be observed that group A was composed by dentures made with face-bow using technique I and group B, made without face-bow using technique II.

Discussion

It was observed that dentures in Group B, made without use of face-bow presented higher number of

Table 1
Number of occlusal contacts in groups A and B

Contacts	Centric relation		Left lateral movement		Right lateral movement		Protrusive movement	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
Average	11.90	19.10	12.40	15.30	12.60	15.50	15.70	17.40
Variance	6.77	10.10	25.38	27.34	18.93	20.06	17.34	24.93
n	20	20	20	20	20	20	20	20
p-value	0.005		0.010		0.065		0.331	

n=sample size

Table 2
Number of occlusal contacts at working side in groups A and B

Working side	Left lateral movement		Right lateral movement	
	Group A	Group B	Group A	Group B
Average	6.50	7.70	6.40	8.40
Variance	6.06	8.90	6.71	7.82
n	20	20	20	20
p-value	0.102		0.007	

n=sample size

Table 3
Number of occlusal contacts at balancing side in groups A and B

Balancing side	Left lateral movement		Right lateral movement	
	Group A	Group B	Group A	Group B
Average	5.90	7.60	6.20	7.10
Variance	6.99	6.93	3.96	3.88
n	20	20	20	20
p-value	0.023		0.233	

n=sample size

occlusal contacts in centric relation than Group A for all mandibular positions. It might be due to technique, which shows an inherent difficulty: the resin bases have not enough retention at the time of obtaining individual compensating curves [8,9]. Therefore; the occlusal planes could be inadequately related to alveolar ridges. In Group B denture were made using the teeth mounting guide of Stratos 100 articulator, which allows to obtain an arbitrary occlusal plane at the time of teeth setting. This procedure avoids the error due to technique used in Group I as described above. Both groups presented similar results in excursive jaw movements, establishing a balanced articulation. Slightly better results could be seen for Group B, probably referred to the same inaccuracy related to the use of standard guides for teeth setting. Group B presented better esthetic than Group A. It could be due to the technique used in setting of teeth. Group A teeth setting depends on dentist and technician's ability to achieve all esthetic requirements during wax rims individualization. Group B teeth setting respects cast analysis, which reproduces individual characteristics, despite dental staff's ability to reproduce esthetics. Group B received more favourable answers

Table 4
Number of occlusal contacts at protrusive movements between groups A and B

Protrusive movement	Anterior		Posterior	
	Group A	Group B	Group A	Group B
Average	4.60	4.70	11.10	12.70
Variance	3.82	4.90	7.66	14.23
n	20	20	20	20
p-value	0.725		0.373	

n=sample size

Table 5
Patients answers regarding denture

Answer	Group A	Group B	p-value
Bad	25%	0%	0.17
Satisfactory	35%	30%	0.736
Very good	40%	70%	0.057

than Group A for chewing and speaking functions. This result confirms that comfort, stability and less stress to the supporting tissues come from an adequate balanced occlusion [10]. Thus, since Group B presented greater aesthetics and comfort, all patients preferred dentures from this group.

Considering the methodology applied and the sample analyzed, one can conclude that both groups obtained balanced occlusion and occlusal contacts in all mandibular excursions. However, Group B presented better results than Group A, even without face-bow. Stratos100 articulator presented an unexpected performance and could be used as a source to obtain balanced occlusion during complete denture fabrication.

Conclusion

One of the most important requirements for successful complete dentures is achieving balanced occlusion. In order to achieve this, it is necessary to reproduce centric relation and use an adequate articulator.

Articulators reproduce patient's characteristics with more accuracy. However, fully adjustable articulators are not practical, since they present high cost, demand knowledge of equipment and require long chair side time. On the other hand, non adjustable articulators are easy to handle, but do not help in achieving balanced occlusion,

resulting in prolong chair side time spent on occlusal adjustments. Therefore, semi adjustable articulators seem to present the most adequate effective tool for complete dentures. These articulators have been found to be easy to handle and allows in achieving a full balanced occlusion during mandibular excursions, accommodating individual characteristics of each patient.

Face bows have been widely used to transfer patient's occlusal plane inclination to semi adjustable articulators. However, there is not enough evidence to suggest that the use of face bow result in increased clinical quality. It is concluded that both groups obtained balanced occlusion and occlusal contacts in all mandibular excursions, however, Group B presented better results than Group A, even without face-bow. One of the most compelling challenges facing the service prosthodontist is the responsibility to provide quality dentures to an ever-increasing patient clientele within the available constrains of time and manpower resources. Quite obviously, the increased amount of time spent in treatment would result in lesser number of patients who could be rehabilitated. It is with this background that this study was undertaken to evaluate new technique, which claimed to reduce treatment time while retaining the quality of treatment.

Conflicts of Interest

This study has been financed by research grants from the O/o DGAFMS, New Delhi.

Intellectual Contribution of Authors

Study Concept : Lt Col M Kumar

Drafting & Manuscript Revision : Lt Col M Kumar

Statistical Analysis : Col DSJ D'Souza, Lt Col M Kumar

Study Supervision : Lt Col M Kumar, Col DSJ D'Souza

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ERRATUM

Case Report : "A Case of Intravaginal Foreign Body" MJAFI July 2010; 66 266-8.

For : Sqn Ldr N Magon, Clinical Tutor (Dept of Obstetric & Gynaecology), AFMC, Pune-40.

Read : Sqn Ldr N Magon, Resident (Dept of Obstetric & Gynaecology), AFMC, Pune-40.

The error is regretted.