Satisfaction Levels in Bilateral Balanced Occlusion and Centric Occlusion in Complete Denture Patients and Its Co-Relation to Mandibular Condyle-fossa Relationship: An In-vivo Study

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Abstract

The association between dental occlusion and mandibular condyle/fossa relation has long been debated and still remains one of the most controversial issues in Prosthodontics. The aim of the study was to determine if balanced or non- balanced occlusion, which out of these is most satisfactory to the patient as well as the change in the mandibular condyle to fossa relationship in both these types of occlusion. Fifteen edentulous patients were selected with good neuromuscular control. For each patient two pairs of dentures were fabricated with balanced occlusion and non- balanced occlusion. Condylar position was recorded using a TMJ tomogram and the satisfaction levels recorded using a questionnaire OHIP-EDENT following the process of insertion. Subsequent to laboratory remounting, the denture insertion was done and tomograms were taken again for both the dentures separately. Two methods were used to evaluate the condyle/fossa relation viz. (1) Zhang's method (2) Brewka's method. The obtained values were then subjected to statistical analysis. The mandibular concentricity were analyzed after the insertion of dentures with the two different occlusal forms. Statistical analysis indicated that statistically significant difference is seen in both the satisfaction levels and the changes in the mandibular condyle- fossa relationship. Thus within limitations of this study it was concluded that there is a significant difference in the satisfaction levels as well as the condyle-fossa relationship when dentures with balanced and non-balanced occlusion were used.

Key words: Mandibular condyle , Temporo-mandibular joint anatomy ,Posterior occlusion, satisfaction in dentures, balanced occlusion

Introduction

Satisfaction with the usage of complete dentures for patients can be considered as an important indicator of an edentulous patient's quality of life. A good prosthesis is the one which has good retention, support and good stability.[1] The temporo-mandibular joint is the major indicator for the inter relationship between the maxilla and mandible. A deeper knowledge about this joint will give a basic understanding of the stomatognathic system in our body. In order to understand this process we have been introduced to a term called as centric relation. For achieving this stable relationship a much thorough insight into the position of the condyles need to be looked at. The position of the condyle must be such that each condyle is associated accurately with its disk and the condyle disk assembly is associated accurately in its fossa in the centric relation position. This is the foundation of an ideal occlusion.[2]

In order to identify the condylar position we use 3 types of positions in the condyle that can be recognized.

(1) Condylar concentricity: This is the most stable position, wherein the posterior joint spaces and anterior joint spaces are equal.

(2) Posterior condylar position, wherein the posterior joint space is reduced than its anterior counterpart.

(3) Anterior condylar position: wherein the anterior joint space is reduced than the posterior joint counterpart.[3]

Close attention needs to be given to the factors involved in the good fabrication of complete denture because the need and the demand for complete denture is never going to reduce or degrade. Keeping these views in mind the satisfaction of the patient when using a balanced and a non-balanced denture were analyzed and the changes in the mandibular condyle/fossa relationship was evaluated by also taking into consideration the findings that are evident in an edentulous TMJ.

Materials and methods

The sample size was taken as 15 patients which included 11 male and 4 female patients. Patients in the age group of 40-65 years with a mean age of 52 and half years were considered. Clinical examination comprising of complete medical history and oral examination was carried out. Examination and the palpation of the temporo-mandibular joints were done in all patients. Since this study involved radiation exposure to the involved subjects, a written consent was obtained from each patient after full explanation of the procedure. Clearance from the ethical committee was obtained to carry out the study.

The inclusion criteria includes patients having ideal maxillo-mandibular relationships (class I and mild class II Skeletal base classification), absence of severely resorbed ridges, subjects with well-rounded upper and lower ridges, completely edentulous for at least 1 month and no history of temporo-mandibular disorders. The exclusion criteria were patients with, uncontrolled systemic disease, neuromuscular disorders, patients in the pediatric age group who are edentulous due to any syndrome, history of temporo-mandibular joint disorders or symptoms related to disease of the stomatognathic system and unwillingness to remain in the study.

Routine steps were performed till final impression to get the master casts. The master casts were then duplicated (Silicone duplicating material -Elite Double 22 Fast, Zhermack) to fabricate two different dentures for each patient. Wax rims were fabricated on the temporary denture base. Tentative jaw relations were recorded and centric relation was recorded. One set of these rims was fused according to the patient's centric relation and mounted on a three point articulator. Using a Hanau spring

Bow, face bow transfer of the patient was done on the second set of rims. Centric relation the patient was recorded and the lower cast was mounted on the Hanau wide-vue articulator. Extra oral tracers or Gothic arch tracers were attached to the maxillary and the mandibular occlusal rims for the verification of the tentative centric jaw relation recorded. Intra oral tracers were attached to make the centric and protrusive occlusal records to be used during the arrangement of teeth. Gothic arch tracing was done. Inter-occlusal plaster records for centric and protrusive relation were made and the readings recorded. Using the protrusive records the horizontal condylar guidance was calculated, applying the Hanau formula.

L = H/8+12

When the centric relation did not coincide with the records made, the mandibular cast was remounted in the new centric relation.

Preparation of dentures with non-balanced occlusion

After the first set of wax rims are mounted in a three point articulator the teeth arrangement was done in a normal class I arrangement. Uniform contacts were established in centric occlusion that was recorded in the patient. Then the denture was tried in the patient's mouth and the arrangement of the teeth verified. Once confirmed, the conventional procedures of flasking, de-waxing, packing and curing were followed and the dentures were obtained. The dentures were trimmed, finished and polished and inserted into the patient's mouth. Required adjustments were made and the denture given to the patients. The patients were advised to use the denture continuously for a period of 4 weeks and then report after the complete settling of the denture bases for the further analysis. When the patients reported again after a period of 4 weeks they were given a questionnaire form of the OHIP- EDENT (19 item version) - Oral Health Impact Profile for Edentulous patients and asked to fill up questions related to the denture satisfaction. Then a temporo-mandibular joint tomography was performed with the denture in the mouth and the mouth closed in the centric occlusion. The required data for analysis was obtained in these steps.

Preparation of dentures with a balanced occlusion:

After the mounting of the wax occlusal rims in the Hanau wide vue articulator and verifying the centric, the teeth arrangement was done in a class I relation. Uniform contacts were first established and verified in centric relation. Then the protrusive records were used and the teeth were balanced to attain uniform contacts in both centric and eccentric positions. After the trial procedure was done satisfactorily the final dentures were processed and inserted in the patient's mouth. The denture usage period of 4 weeks were given to the patients and then after this period the patients were given the same questionnaire used before. TMJ tomogram was also taken with the balanced denture in the mouth. The required data for analysis was obtained and recorded.

Determination of the change in the relationship of the condyle to fossa

A TMJ tomogram, by the radiologist of the institute was taken using a KODAK digital tomogram machine. The tomogram of the patient was taken at two stages during the study. One taken after 4 weeks of use of the non-balanced denture and other taken 4 weeks after the use of a balanced denture. For determining the joint space between the glenoid fossa and condyle the method provided by Zhang Zenkhang [4] was used and for the determination of the center of the condyle and the fossa the method given by Brewka[5], Willis[6] and Hatgigioris[7] was used. All the tracings were done by the same clinician. And the tomograms were randomized and also blinded to the tracing clinician before they were processed for tracing.

Tracing methods: For tracing the following guidelines were used

For measurement of the joint space between the condyle and the glenoid fossa the method suggested by Zhang Zhenkang[4] was used. Accordingly a reference line was drawn parallel with the Frankfort horizontal plane and tangent to the superior most aspect of the glenoid fossa. From the highest point of the glenoid fossa, line A was drawn perpendicular to the reference line. Line B was drawn at an angle of 45 º to the line across the thinnest part of the joint. Line C was also drawn at 45º to the reference line passing through lines A and B. Line C also passes through the posterior joint space. The length of lines A, B and C between the condyle and the glenoid fossa were calculated and denoted the width of the upper anterior, superior and posterior joint spaces.(fig 1)

Method 2: The center of the condyle and the center of the fossa were located according to method described by Brewka[5], Willis[6], and Hatjigiorgis[7]. Line 1 was drawn parallel to the reference line and tangent to the highest point of the condyle. Line 2 perpendicular to line 1 and tangent to the anterior most aspect of the condyle. Line 3 was drawn parallel to line 2 and tangent to the posterior most aspect of the condyle. Line 4 was drawn parallel to line 1 and at a distance to line 1 equal to that between line 2 and line 3. These four lines intersect to form a square. The intersection point of the two diagonals of this square denoted the center of the mandibular condyle. Line E–F was drawn parallel to the reference line and tangential to the crest of the articular eminence. The line representing the X-axis was drawn further midway between and parallel to line E–F and the reference line. The line perpendicular to the reference line at the point where the reference line intersected the height of the fossa represented the Y-axis. The point of intersection of the X- and Y-axes indicated the center of the glenoid fossa. The distance from the center of the condyle to the center of the glenoid fossa on the X-axis and the Y-axis was measured and recorded.

The records and values which were obtained were collected tabulated and proceeded with a statistical analysis of the data. (fig.2)

Results

The t test was used to test the null hypothesis which stated there is no difference in mandibular condyle/ fossa relationship in both balanced and non-balanced occlusion. The t test showed there is a significant difference in the mandibular condyle/ fossa relationship in the y axis of the right and left condyles and only in the x axis of the left condyle. Also the t test showed that there is a significant difference in the right and left superior and posterior joint spaces and no statistically significant difference in the anterior joint spaces.

Refer tables 1- 10

Satisfaction levels in balanced and non- balanced dentures: The OHIP (EDENT) QUESTIONNAIRE has been divided into 7 parts to evaluate the satisfaction levels of the patients when using a balanced and non- balanced dentures. Chi square test was used and the chi square values were derived and the p value further calculated. It was found that a statistically significant difference was observed in the satisfaction levels of both the dentures. There was a significant difference in the functional limitations of the patients when using balanced and non- balanced dentures. Most patients experienced better fit, lesser food retention and also lesser difficulty during chewing when using a balanced denture than when using a non- balanced denture. When it comes physical pain, sore spots and the feeling of wearing an uncomfortable denture, balanced occlusion again proved to be better significantly than the non-balanced occlusion. Most patients complained that they avoided eating some food

and also had to interrupt eating between meals when using dentures with a non-balanced occlusion whereas this problem was not seen with the use of balanced occlusion. There also proved to be a statistically significant difference in the social well-being of the patients when using a balanced occlusion denture than a denture with non-balanced occlusion.

Refer tables 11-17.

Discussion

Shirani. M. et al[1] compared the satisfaction levels in three different types of occlusion (1) fully bilateral balanced occlusion,(2) lingualised occlusion and (3) buccalised occlusion. The results showed that, fully bilateral balanced occlusion scored significantly higher for uncomfortable eating and avoidance of particular foods than lingualised occlusion. Also, fully bilateral balanced occlusion scored significantly higher for avoiding particular food and physical disability than buccalised occlusion. Furthermore, fully bilateral balanced occlusion scored significantly lower for uncomfortable dentures than lingualised occlusion.

Guttal SS et al[2] compared the change in mandibular condyle/fossa relationship with the use of anatomic and semi anatomic teeth in complete denture prosthesis. They had drawn conclusions showing: The condyle/fossa relation recorded during the jaw relation remained the same when dentures with anatomic teeth or dentures with semi anatomic teeth were used and does not show any significant change between the two types of tooth forms.The type of the tooth form used for processing dentures had no bearing on the condyle/fossa recorded during the jaw relation procedure.

Amorim VC et al[8] analysed the condyle/fossa relationship before and after prosthetic rehabilitation with maxillary complete denture and mandibular removable partial denture. They concluded that significant changes in the condylar position occurred after prosthetic rehabilitation in subjects without symptoms of TMDs. Before prosthetic rehabilitation, a predominance of posterior condylar positions was observed. There was a decrease in posterior positioning, which was more marked after prosthetic rehabilitation. The subjective evaluation and comparison on the basis of drawings and tracings used to analyse the tomograms produced similar results.

The study has some limitations such as it did not include many other different occlusal patterns in the same denture base .Since the sample size for this study was small (15 subjects), future studies can be performed on this topic with larger sample size.

Also the study does not evaluate the role of different occlusal tooth forms and posterior occlusal schemes on the condyle/fossa relations in different eccentric positions. Therefore, the further scope of this research is to evaluate the effect of two different tooth forms and even include various other occlusal schemes on the condyle/fossa relation in various eccentric positions and to perform a similar study on this topic with a larger sample size.

Conclusion

Within the limitation of the study the following conclusions were.

- There was no significant difference between the right X axis with balanced and non-balanced occlusion.

- There was significant difference between the right Y axis, left X axis and left Y axis with balanced and non-balanced occlusion. There was more deviation in the non-balanced occlusion as compared to the balanced occlusion.

- There was no significant difference between the Right and left anterior region with balanced and non-balanced occlusion. There was no difference in deviation in the Right and Left anterior region in the

non-balanced occlusion as compared to the balanced occlusion.

- There was a significant difference between the Right and left posterior region and also in the right and left superior region with balanced and non-balanced occlusion. There was significant difference with more deviation in the Right and left posterior region and in the right and left superior region in the non-balanced occlusion as compared to the balanced occlusion.

When it comes to satisfaction levels in these two posterior occlusal schemes in dentures which was determined using the OHIP – EDENT (19 item version) questionnaire there was a better satisfaction quotient in balanced dentures than in non- balanced dentures. The following conclusions were drawn after the statistical analysis of the questionnaire. The conclusions were as follows.

- There was a significant difference in the functional limitations of the patients when using balanced and non-balanced dentures. Most patients experienced better fit, lesser food retention and also lesser difficulty during chewing when using a balanced denture than when using a non- balanced denture.

- When it comes physical pain, sore spots and the feeling of wearing an uncomfortable denture, balanced occlusion again proved to be better significantly than the non-balanced occlusion.

- Most patients complained that they avoided eating some food and also had to interrupt eating between meals when using dentures with a non-balanced occlusion whereas this problem was not seen with the use of balanced occlusion.

- There also proved to be a statistically significant difference in the social well-being of the patients when using a balanced occlusion denture than a denture with non-balanced occlusion.

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Legends Tables

Table 1: Comparison of change in Right X Axis between balanced and non-balanced denture

Group	N	Mean	Std. Deviation	T value	P value
Non-balanced	15	-6.049	0.25	0.07	.94
Balanced	15	-6.041	0.25		

The change in the right X- axis was not significant between the two dentures

Table 2: Comparison of change in Right Y Axis between balanced and non-balanced denture

Group	N	Mean	Std. Deviation	T value	P value
Non-balanced	15	-5.83	0.22	6.62	.01*
Balanced	15	-5.13	0.34		

The change in the right Y- axis was significant between the two dentures

Table 3: Comparison of change in Left X Axis between balanced and non-balanced denture

Group	N	Mean	Std. Deviation	T value	P value
Non-balanced	15	-6.18	.17	2.40	0.02*
Balanced	15	-6.02	.18		

The change in the left X- axis was significant between the two dentures

Table 4: Comparison of change in Left Y Axis between balanced and non-balanced denture

Group	N	Mean	Std. Deviation	T vlaue	P value
Non-balanced	15	-5.70	.25		
Balanced	15	-5.46	.31	2.20	.032*

The change in the left X- axis was significant between the two dentures

Table 5: Comparison of change in Right Anterior joint space between balanced and non-balanced denture

Group	N	Mean	Std. Deviation	T value	P value
Non-balanced	15	2.49	.17	1.67	.10
Balanced	15	2.37	.21		

The change in the right anterior joint space was not significant between the two dentures

Table 6: Comparison of change in Right Posterior joint space between balanced and non-balanced denture

Group	N	Mean	Std. Deviation	T value	P value
Non-balanced	15	2.88	.17	5.31	.01*
Balanced	15	2.51	.20		

The change in the right posterior joint space was significant between the two dentures

Table 7: Comparison of change in Right Superior joint space between balanced and non-balanced denture

Group	N	Mean	Std. Deviation	T value	P value
Non-balanced	15	4.09	**.22**	3.54	.01*
Balanced	15	3.74	**.18**		

The change in the right superior joint space was significant between the two dentures

Table 8: Comparison of change in Left Anterior joint space between balanced and non-balanced denture

Group	N	Mean	Std. Deviation	T value	P value
Non-balanced	15	2.45	**0.33**	0.56	.57
Balanced	15	2.39	0.22		

The change in the left anterior joint space was not significant between the two dentures

Table 9: Comparison of change in Left Posterior joint space between balanced and non-balanced denture

Group	N	Mean	Std. Deviation	T value	P value
Non-balanced	15	3.18	.21	3.40	.01*
Balanced	15	2.92	.20		

The change in the left posterior joint space was significant between the two dentures

Table 10: Comparison of change in Left Superior joint space between balanced and non-balanced denture

Group	N	Mean	Std. Deviation	T value	P value
Non-balanced	15	4.02	**.16**	2.77	.011*
Balanced	15	3.84	.17		

The change in the left superior joint space was significant between the two dentures

Table 11: Comparison of Functional Limitation among patients with balanced and non-balanced dentures

Question	Group	Never	Sometimes	Fairly often	Very often	Chi Square	P value
difficulty in chewing any food	NB	0	5	9	1	19.09	0.01*
	B	9	6	0	0		
denture retain food	NB	0	3	10	2	13.91	0.01*
	B	3	12	0	0		
dentures are not correctly fit	NB	0	5	2	8	19.09	0.01*
	B	9	6	0	0		

There is a significant difference in the functional limitation between the two dentures with balanced dentures providing much less limitation in use.

Table 12: Comparison of Physical Pain among patients with balanced and non-balanced dentures

Question	Group	Never	Sometimes	Fairly often	Very often	Chi Square	P value
mouth painful	NB	3	7	4	1	7.15	0.03*
	B	8	6	1	0		
discomfort while eating	NB	1	3	11	0	17.43	0.01*
	B	5	10	0	0		
sore spots	NB	0	3	11	1	14.29	0.01*
	B	5	8	2	0		
uncomfortable dentures	NB	1	2	3	9	19.48	0.01*
	B	7	5	3	0		

There is a significant difference in physical pain between the two dentures with balanced dentures being less cause for physical pain in use.

Table 13: Comparison of Psychological Discomfort among patients with balanced and non-balanced denture

Question	Group	Never	Sometimes	Fairly often	Very often	Chi Square	P value
worried by dental problems	NB	0	2	6	7	10.79	0.013*
	B	7	5	3	0		
self conscious because of your mouth or dentures	NB	1	2	7	2	9.37	0.026*
	B	6	6	3	0		

Table 14: Comparison of Physical Disability among patients with balanced and non-balanced dentures:

Question	Group	Never	Sometimes	Fairly often	Very often	Chi Square	P value
avoided eating anything due to problems with your mouth or dentures	NB	2	7	1	5	7.31	0.04*
	B	2	12	1	0		
interrupt meals due to problems with mouth or dentures	NB	0	7	6	2	14.56	0.01*
	B	3	11	1	0		

There is a significant difference in physical disability between the two dentures with balanced dentures providing much less disability duing use

Table 15: Comparison of Psychological Disability among patients with balanced and non-balanced dentures:

Question	Group	Never	Sometimes	Fairly often	Very often	Chi Square	P value
upset because of problems with teeth or mouth or dentures?	NB	1	1	6	7	21.31	0.01*
	B	3	10	2	0		
embarrassed because of problems with mouth or dentures?	NB	0	4	8	3	13.65	0.01*
	B	7	5	2	1		

There is a significant difference in the psychological disability between the two dentures with balanced dentures being more comfortable in use.

Table 16: Comparison of Social Disability among patients with balanced and non-balanced dentures

Question	Group	Never	Sometimes	Fairly often	Very often	Chi Square	P value
less tolerant of your spouse of family because of problem with dentures	NB	3	7	4	1	7.15	0.03*
	B	8	6	1	0		
Irritable with other people because of problems of mouth or dentures?	NB	5	8	2	0	14.29	0.01*
	B	0	3	11	1		
avoid leaving home due to problems with your mouth or dentures?	NB	5	10	0	0	17.43	0.01*
	B	1	3	11	0		

There is a significant difference in the social disability between the two dentures with balanced dentures giving more confidence to the patients when in use.

Table 17: Comparison of Handicap among patients with balanced and non-balanced dentures:

		Never	Sometimes	Fairly often	Very often	Chi Square	P value
enjoy other people's company as much because of problems with mouth or dentures	NB	11	3	0	1	22.94	0.01*
	B	1	0	6	8		
Life in general was less satisfying due to problem with your mouth or dentures?	NB	3	0	7	2	17.29	0.01*
	B	9	6	0	0		

There is a significant difference in handicap felt by the patients between the two dentures with balanced dentures improving the quality of life of the patients when in use.