INTRODUCTION

The World Health Organization (WHO) defines health as “a state of complete physical, mental and social well-being, not merely the absence of disease or infirmity”. This modern approach to health lends itself to oral health as well. Loss of teeth results in compromised facial aesthetics and loss of function. It is a very difficult situation, even worse when the patient is completely edentulous. Most of the edentulous patients are rehabilitated by providing them with complete dentures. The success of complete dentures is related to the quality of the impressions and chewing efficiency of the patients. The scheme of occlusion of complete denture is one of the factors which affects the chewing pattern and masticatory efficiency of the patients. With dentures, the quantity and the intensity of contacts determine the amount and the direction of the forces that are transmitted through the bases of the denture to the residual ridges. That is why the occlusal scheme is considered an important factor in the design of complete dentures.

Both balanced occlusion and lingualized occlusion are recommended for complete dentures. Anatomical as well as non-anatomical molds of teeth can be used in both concepts. Balanced articulation is described as the occlusal contacts of maxillary and mandibular teeth initially in maximum intercusitation, and their continuous contacts during movements from this position along specific working, balancing and protrusive guidance pathways developed on the occlusal surface of the teeth. It is considered an ideal occlusion for complete dentures.

Lingualized occlusion gives the patient improved comfort, function and appearance, quality-of-life goals sought by the clinician and patient alike. The principle of lingualized occlusion aims at stabilizing the
prosthesis. It is based on maxillary palatal cusps functioning as the main supporting cusp in harmony with the occlusal surfaces of mandibular teeth. To date, it is unclear if patients notice differences in their ability to chew when they wear complete dentures manufactured with lingualized occlusal scheme when compared with dentures made with a bilateral balanced occlusion in Pakistan. Therefore, it was the aim of this study to compare the masticatory efficiency with two differently fabricated occlusal schemes of complete dentures.

**METHODOLOGY**

Sixty edentulous patients between the ages of 45 – 65 years with no previous complete denture experience reporting to the Department of Prosthodontics for provision of new complete dentures were included in this study. Patients having any soft tissue abnormality e.g. epulis fissuratum, hyperplasia were excluded from the study. Likewise, patients having any congenital defects, neurologic/psychiatric disorders were also excluded.

Patients of both genders were randomly distributed into two groups in order to minimize the confounding effect of this variable (gender). Complete medical/dental history, clinical examination and investigations including periapical radiograph and orthopantomogram if required were carried out. Consent was obtained in this regard from the patients.

A computer was used to randomly divide 60 patients into two groups of 30 each, i.e. Group A and Group B by using Statistical Package for Social Sciences (SPSS version 10) software. Later on, as the patients came, they were numbered in a sequence of 1-60 according to date of arrival in the department and placed into these pre-sorted groups. Group A patients were provided with complete dentures fabricated with bilateral balanced occlusal scheme while those in Group B were provided with complete dentures fabricated with lingualized occlusal scheme.

Upper and lower complete dentures were constructed by the same clinician following standardized clinical techniques. The teeth setup of complete dentures with lingualized occlusion was arranged as follows: the functional maxillary palatal cusps of the posterior teeth were set in the central groove of the mandibular posterior teeth in lateral and protrusive excursions. The maxillary buccal cusps were elevated and had no contact with the mandibular buccal cusps in both centric and eccentric movements. The 20° semi-anatomic commercial artificial teeth (Simpler AC, manufactured by Yamahachi Dental MFG.CO. Japan) were used for the lingualized occlusion group’s teeth arrangement.

The teeth setup of complete dentures with bilateral balanced occlusion was arranged as follows: the functional maxillary palatal cusps of posterior teeth were set in the central groove of the mandibular teeth, and the maxillary buccal cusps were kept in contact with mandibular buccal cusps. The buccal cusps and palatal cusps were in articulation and functional in the bilateral and protrusive excursions. The 20° semi-anatomic commercial artificial teeth (Naperce, manufactured by Yamahachi Dental MFG.CO. Japan) were utilized for the bilateral balanced occlusion group’s teeth arrangement.

After the teeth setup, trial of the denture was carried out in the patient’s mouth. After necessary laboratory procedures by the same technician in the dental laboratory within the institution, final prostheses were inserted. After insertion, in both groups, necessary occlusal adjustments were done. Instructions were cited and follow-up visit scheduled. When the patients were free of post insertion complaints then patient masticatory efficiency was assessed after 2 months of denture insertion.

Masticatory efficiency test was conducted using Sieving method. Two tests were conducted using 15 gms peanuts in each test. Peanuts were divided into five portions of 3 gms using an electrical balance (AND HR-200 by AND company limited, Japan) for each test. In the first test, patients were asked to chew each portion for 15 seconds and spit out the contents in a given container. Patients were given a tumbler of water and were asked to rinse thoroughly and release the remaining contents in the same container. The procedure was repeated 5 times with every portion of 3 gm peanuts. The chewed material was collected, pooled and passed through a 10-mesh screen sieve (U.S. Standard Testing Sieve by Mughal Test, Pakistan). Second test was conducted using same
methodology but patients were asked to chew each portion till the material was ready to swallow. Rest of the methodology was kept same. The chewed material was left on a blotting paper for 30 minutes after it was passed through the sieve and weighed using an electrical balance with an accuracy of 0.01g for both the tests. Mean of both tests were calculated and analyzed.

Data were entered to statistical software SPSS (version 10) for analysis. The variables under study were age; gender and weight of masticated peanuts after 15 second and at swallowing threshold with time. Mean with standard deviation, 95% confidence interval, median with IQR were computed for age and weight of masticated peanuts after 15 second and at swallowing threshold with time. Qualitative variable (gender) was calculated as frequency and percentage. Non-parametric Mann-Whitney U test was applied instead of independent sample t test due to not normal continuous variables for significance of patient’s masticatory efficiency will be compared of both. Chi Square test was also applied to compare gender proportion between groups. Significance level was set at p 0.05.

RESULTS

A total of 60 edentulous patients were included in this study. Patients were divided into two groups of 30 each by random numbering table marked as A and B. The average age of the patients was 53.63±4.5 years (95%CI 52.47 to 54.8). The mean weights of masticated peanuts after 15 seconds and at swallowing threshold with time are presented in table 1. Out of 60 patients, 34(56.7%) were male and 26(43.3%) were female with 1.31:1 male to female ratio. In group A 18(60%) were male and 12(20%) were female while in group B, 16(53%) were male and 14(46.7%) were female. Significant difference was not observed between the groups for gender distribution (Chi-Square value 0.27 DF 1 P-value 0.602).

Comparison of weight (mean weight of 5 times with every portion of 3 gm peanuts) of masticated peanuts after 15 seconds between groups is presented in figure 1. The median (IQR) of mean weight of masticated peanuts after 15 seconds was 2.22(0.56) g in lingualized occlusion groups and 2.27(0.26) g in balanced occlusion groups. Median difference was not statistically significant between the groups (Mann-Whitney U test= 375, p=0.267). The average of mean weight of masticated peanuts after 15 seconds for both groups is also presented below the figure 1.

Comparison of weight (mean of 5 times with every portion of 3 g peanuts) of masticated peanuts at swallowing threshold between groups is presented in figure 2. The median (IQR) of mean weight of masticated peanuts at swallowing threshold was 1.24(0.52) g in lingualized occlusion groups and 1.47(0.46) g in balanced occlusion groups. Median difference was statistically significant between the groups (Mann-Whitney U test= 307, p=0.034). The median weight of masticated peanuts was significantly low in lingualized occlusion groups than balanced occlusion groups at swallowing threshold. Comparison of time (sec) of swallowing threshold of masticated peanuts between groups was also not significant as shown in figure 3.

DISCUSSION

The statistically significant result of this study proved the hypothesis that masticatory efficiency is better with complete dentures fabricated by lingualized occlusal scheme as compared to those fabricated by bilateral balanced occlusal scheme.

<table>
<thead>
<tr>
<th>Study Variables (Unit)</th>
<th>Mean ± SD</th>
<th>95% CI</th>
<th>Median(IQR)</th>
<th>Max - Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Years)</td>
<td>53.63 ± 4.5</td>
<td>52.47 to 54.8</td>
<td>53 (8)</td>
<td>60 – 46</td>
</tr>
<tr>
<td>Mean weight (gm) of masticated peanuts after 15 seconds</td>
<td>2.187 ± 0.30</td>
<td>2.11 to 2.26</td>
<td>2.3(0.28)</td>
<td>2.69 – 1.57</td>
</tr>
<tr>
<td>Mean weight (gm) of masticated peanuts at swallowing threshold</td>
<td>1.31 ± 0.37</td>
<td>1.21 to 1.40</td>
<td>1.4(0.47)</td>
<td>1.92 – 0.48</td>
</tr>
<tr>
<td>Time (sec) of swallowing threshold</td>
<td>51.84 ± 16.53</td>
<td>47.57 to 56.1</td>
<td>49.1(21.7)</td>
<td>93.97 – 26.7</td>
</tr>
</tbody>
</table>

CI = Confidence Interval, IQR = Interquartile range, Max = maximum observation, Min = Minimum observation, sec = seconds, gm = grams, SD = Standard Deviation
Patients provided with dentures fabricated with lingualized occlusal scheme were more comfortable with their dentures. They were able to chew properly with ease and comfort. No such study was conducted before in Pakistan to assess the masticatory efficiency of patients by comparing both the occlusal schemes.

In order to minimize the confounding effect of age, 45 to 65 year age group was included in the study. Patients below the age of 45 years were not included in the study in which neuromuscular coordination is better and might have confounded the study with reference to patient masticatory efficiency level.11

In the dental literature, many reports have been published showing that professionally assessed quality of complete dentures does not agree with patient’s subjective judgments.12 Awad and Feine13 as well as Heydecke et al14 suggested that patient’s satisfaction with their prostheses could not be inferred from the clinician’s impression of and satisfaction with newly provided prostheses. Therefore, the focus of this study was on patient chewing efficiency as the main outcome.

In this study, patients showed their ability to chew and masticate significantly better when provided dentures were fabricated with lingualized occlusal scheme. Koide15 investigated the masticatory performance of edentulous patients wearing complete dentures arranged with lingualized occlusion and bilateral balanced occlusion. It was found that lingualized occlusion offered a higher ability of food crushing, showed higher masticatory efficiency, displayed faster as well

Fig. 1: Comparison of weight (gm) of masticated peanuts after 15 seconds between groups

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Balanced occlusion</th>
<th>Lingualized occlusion</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median (IQR)</td>
<td>2.27(0.26) gm</td>
<td>2.22(0.56) gm</td>
<td>0.267</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>2.23±0.27 gm</td>
<td>2.14±0.32 gm</td>
<td></td>
</tr>
</tbody>
</table>

Mann-Whitney U test (two tailed) = 375
Box and whisker plot shows median comparison between groups. Block line in the box shows median of mean weight of masticated peanuts. Small circles show outliers.

Gm = grams.
as smoother masticatory movement, and showed chewing patterns that were closer to the chopper type compared with bilateral balanced occlusion.

The result of this study also confirms the findings by Gomibuchi et al\(^\text{16}\) who compared dentures with anatomical teeth either arranged for bilateral balanced or lingualized occlusion dentures. Patients in his study expressed better chewing ability with lingualized occlusion dentures, suggested that lingualized occlusion is effective in masticating or cut food, and are the form of occlusion having a high cutting potential compared to bilateral balanced occlusion.

Kimoto et al\(^\text{17}\) in the study found that edentulous patients provided with complete dentures fabricated with lingualized occlusal scheme experienced and expressed greater satisfaction with their denture retention and resulted in greater masticatory performance.

However Ono and Hatake\(^\text{18}\) did not found any significance in complete dentures arranged with lingualized occlusal scheme affecting masticatory performance. It was reported that the chewing ability of patients with lingualized occlusion and those with bilateral balanced occlusion was 44.5% and 46.8% respectively.

Heydecke et al\(^\text{19}\) compared the masticatory efficiency between complete dentures arranged with canine guided occlusion and lingualized occlusion. He found that patients provided with complete dentures of canine guided occlusal scheme showed better masticatory ability compared to complete dentures arranged with lingualized occlusion.
A number of authors have proposed a lingualized occlusal scheme as the most beneficial concept for complete dentures.\textsuperscript{20}

The complete dentures arranged with lingualized occlusion significantly affect masticatory efficiency. The concept of lingualized occlusion ought to be applying in prospect for fabrication of complete dentures. With the use of specific moulds of teeth, the scope and practicality of lingualized occlusal scheme can bring forward favorable results in terms of patient’s satisfaction with different types of prosthesis.

CONCLUSIONS

Within the limitations of this study, the conclusion is that the masticatory efficiency was higher in patients who were provided with complete dentures fabricated with the lingualized occlusal scheme as compared to those patients who received complete dentures made with balanced occlusal scheme. This was due to the fact that lingualized occlusal technique resulted in functionally better complete dentures as compared to the ones made by balanced occlusal technique. In addition to that more research work needs to be carried out in our population to assess the benefits of these occlusal schemes in the fabrication of partial dentures and other prosthesis as well.

REFERENCES

Masticatory Efficiency between Balanced and Lingualized Occlusion


7 Tarazi E, Ticotsky-Zadok N. Occlusal schemes of complete dentures—a review of the literature. Refuat HaPeh Vehashinayim 2007; 24: 56-64, 85-86.


