Double-blind study for evaluation of complete dentures made by two techniques with and without face-bow.

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The aim of this article was to compare complete dentures made by two techniques: with and without face-bow. Five 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 and artificial teeth. Teeth were set using individualized wax ridges as guides. The other technique used an articulator, 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, as well as the opinion of patients regarding denture bearing during oral functions. Both groups presented balanced dentures, but the technique that avoids face-bow presented better results regarding to esthetics, comfort and stability. Balanced occlusion was provided even without face-bow and could be an alternative to obtain adequate complete dentures.

**Key Words:** complete dentures, articulators, occlusion.
Introduction

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. Articulators reproduce patient characteristics with more accuracy. However, full adjustable articulators are not practical, since they present high cost, demand knowledge on equipment and long chairside time. On the other hand, nonadjustable articulators are easy to handle, but do not allow to obtain a balanced occlusion and dentist spend much time on occlusal adjustments. Considering the aforementioned statements, semi adjustable articulators seem to present the most adequate effectiveness/handing 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, Paterson technique is used to get the individual compensating curves, following patient path angles for mandibular movements. However, using face-bow and Paterson technique 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. In fact, in some areas such as Scandinavia, dentists have not used face-bows for 20 years. It is claimed that there is no sufficient evidence that the use of face-bow results in increased clinical quality.

This article compared two different techniques of complete dentures construction. The first used face-bow, Paterson technique and a semi-adjustable articulator (Bio-Art, Brazil). The second used a semi-adjustable articulator (Stratos 200, Ivoclar, Liechteinstein), which avoids the use of face-bow and Paterson technique, using an average mounting based upon patient casts analysis.

Material and Methods

Edentulous subjects were selected at the dental clinic of the University of Vale do Paraíba. The sample was composed by four women and one man. All ethical aspects were considered and respected, since it was previously approved by the Committee of Ethics in Research of the aforementioned University (Protocol Number 039/2001/CEP). Initial examinations were done, as well as first and second impressions. Functional casts were duplicated with laboratory silicone (Figure 1). Casts were then separated in two groups, which were mounted in two different arcon semi-adjustable articulators. The casts of Group A were mounted using a face-bow, in a Bio-Art articulator (Bio-Art, Brazil). Group B casts were mounted without face-bow in a Stratos 200 articulator (Ivoclar, Liechteinstein). For both groups, the same type of teeth (VIPI, Brazil) were used. After wax try-in, all dentures were processed by water bath under a temperature of 74ºC, for 08 hours.

Fig. 1 - Casts duplicated with laboratory silicone.

Group A technique

After mounting the upper cast by face-bow technique, compensating curves were registered and the wax ridges were fixed on centric relation position. Lower casts were then fixed in the articulator. Bennett and condylar path angles were individualized by following the individual compensating curves (Figure 2). Teeth were mounted following the wax ridges (Figures 3, 4 and 5).

Fig. 2 - Casts mounted in the Bio-Art articulator with face-bow (Group A).
Group B technique

Before mounting teeth in Group A, wax ridges were first used to mount Group B casts at Stratos 200, using a technique based upon average values. This technique was developed to avoid the use of face-bow and is specific for this articulator.

Lower casts were fixed first and it was necessary to set out the retromolar pad and labial frenula. Upper and lower wax ridges were fixed together and positioned in the patient’s mouth in centric relation position and vertical dimension of occlusion. So, the distance between upper and lower labial fornix was measured with the aid of a scale (Figure 6). Half of this measurement was transferred to the mobile front shaft of a horizontal guide, specific from this equipment. The horizontal guide was positioned over labial frenula and, its posterior part, over retromolar pad of the cast (Figure 7). Then it was mounted over a fix board united to the upper part of articulator (Figure 8). This procedure is useful for positioning the lower cast, because it permits to describe an arbitrary occlusal plane. Then, lower cast was fixed to the inferior part of articulator with plaster. At the final stage, the wax ridges in centric relation obtained for Group A (before mounting teeth) were placed over the lower cast, positioning the upper cast, which was also fixed with plaster (Figures 9 and 10). Articulator was then adjusted arbitrarily in 15º for Bennett angle and 30º for condylar guide, allourny excursive movements. After that, the wax ridges were repositioned in Bio-Art articulator (Group A), in which they were used for teeth mounting.

Teeth mounting in Group B followed the technique of the Biofunctional Prosthetic System (Ivoclar, Liechteinstein), without using wax ridges guides. The technique described by the manufacturer uses cast analysis, as well as the relation between dental arches and anatomic criteria, like palatal and retromolar pad, wrinkles and maxillary tuber (Figures 11, 12 and 13). These procedures were performed observing adequate overbite, according to Angle Classification of the patient, and balanced occlusion (Figures 14, 15, 16 and 17).
Fig. 7 - After setting the retromolar pads and lower labial frenula, a horizontal guide of the Stratos 200 articulator was positioned over the lower cast.

Fig. 8 - Lower cast positioned in the Stratos 200 articulator (Group B).

Fig. 9 - Wax ridges positioned over the lower cast previously fixed with plaster.

Fig. 10 - Upper cast fixed with plaster to the Stratos 200 articulator.

Fig. 11 - Lower cast analysis for teeth mounting in the Stratos 200 articulator: a) median line b) bilateral lines through the canine areas.

Fig. 12 - Upper cast analysis: incisors positioned next to the anterior papilla.
Results assessments

At denture delivery appointment, only one of the pairs were given to the patient (nor patients or operator knew from which group was the first pair entrusted to the patient — only the technician knew that Group A was composed by dentures made with face-bow and Paterson Technique and Group B, made without face-bow). Occlusal contacts were registered with carbon. They were counted at the superior cast, confirmed at the lower cast and signed. To minimize errors, contacts were done twice in each person, in a total of 10 samples. Patients were instructed to return after 10 days and then answered the Group A part of an appropriate questionnaire (Appendix 1).

The second pair of dentures were then delivered and procedures were repeated. After wearing period, patients were asked to choose one of those pairs, what was 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.

Annex 1
Questionnaire about complete denture bearing

Patient ID number: __________________

Evaluation of Group A dentures:                       Date: __/__/__
1. Comfort during wearing period:
  □ Bad         □ Satisfactory         □ Very Good
2. Stability and safety:
  □ 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:                       Date: __/__/__
1. Comfort during wearing period:
  □ Bad         □ Satisfactory         □ Very Good
2. Stability and safety:
  □ 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:

Results
Occlusal contacts presented a significant statistically 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 great 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 significant difference between groups of dentures (p=0.331) for protrusive movements (Table 1). Lateral movements were subdivided in work and non-work sides, whereas protrusive movements were separated in anterior and posterior contacts. Concerning work side at lateral movements, dentures A presented worse results than dentures B, at right movements (p=0.007), but at left lateral movement, there was no significant difference (p=0.102) as shown in Table 2. A different situation was found in the non-working side, in which Group A obtained worse results at left lateral movement (p=0.023). No significant differences were observed for right movement (p=0.233) in relation to group B (Table 3).

Regarding to protrusive movement (Table 4), there was no 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=0.017) 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 and Paterson technique and group B, made without face-bow.

Discussion
It was observed that Group B, without face-bow and Paterson technique, presented higher number of occlusal contacts in centric relation than Group A for all mandibular positions. It might be due to Paterson technique, which shows an inherent difficulty: the resin bases have not enough retention at the time of obtaining individual compensating curves. Therefore, the occlusal planes could be inadequately related to alveolar ridges.

Group B was made using the teeth mounting guide of Stratos 200, which allows to obtain an arbitrary occlusal plane at the moment of teeth mounting. This procedure avoids the errors due to Paterson technique as described in the above paragraph. 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 application of Paterson technique added to the use of standard guides for teeth mounting.

Group B presented better esthetic than Group A. It could be due to the technique used to mount teeth. Group A mounting depends on dentist and technician ability to achieve all esthetic requirements during wax ridges individualization. Group B mounting respects cast analysis, which reproduces individual characteristics, despite dental staff aesthetic abilities. Group B received more favorable answers 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. Thus, since Group B presented greater esthetics 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, as a rule, Group B presented better results than Group A, even without face-bow. Stratos 200 articulator presented an unexpected performance and could be used as a resource to obtain balanced occlusion during complete denture making.
Table 1- Number of occlusal contacts in groups A and B.

<table>
<thead>
<tr>
<th>Contacts</th>
<th>Centric relation</th>
<th>Left lateral movement</th>
<th>Right lateral movement</th>
<th>Protrusive movement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group A</td>
<td>Group B</td>
<td>Group A</td>
<td>Group B</td>
</tr>
<tr>
<td>Average</td>
<td>11,90</td>
<td>19,10</td>
<td>12,40</td>
<td>15,30</td>
</tr>
<tr>
<td>Variance</td>
<td>6,77</td>
<td>10,10</td>
<td>25,38</td>
<td>27,34</td>
</tr>
<tr>
<td>n</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>p-value</td>
<td>0,005</td>
<td>0,010</td>
<td>0,065</td>
<td>0,331</td>
</tr>
</tbody>
</table>

n= sample size.

Table 2- Number of occlusal contacts at work side in groups A and B.

<table>
<thead>
<tr>
<th>Work side</th>
<th>Left lateral movement</th>
<th>Right lateral movement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group A</td>
<td>Group B</td>
</tr>
<tr>
<td>Average</td>
<td>6,50</td>
<td>7,70</td>
</tr>
<tr>
<td>Variance</td>
<td>6,06</td>
<td>8,90</td>
</tr>
<tr>
<td>N</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>p-value</td>
<td>0,102</td>
<td>0,007</td>
</tr>
</tbody>
</table>

n= sample size

Table 3- Number of occlusal contacts at non- work side in groups A and B.

<table>
<thead>
<tr>
<th>Work side</th>
<th>Left lateral movement</th>
<th>Right lateral movement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group A</td>
<td>Group B</td>
</tr>
<tr>
<td>Average</td>
<td>5,90</td>
<td>7,60</td>
</tr>
<tr>
<td>Variance</td>
<td>6,99</td>
<td>6,93</td>
</tr>
<tr>
<td>N</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>p-value</td>
<td>0,023</td>
<td>0,233</td>
</tr>
</tbody>
</table>

n= sample size.

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

<table>
<thead>
<tr>
<th>Protrusive movement</th>
<th>Anterior</th>
<th>Posterior</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group A</td>
<td>Group B</td>
</tr>
<tr>
<td>Average</td>
<td>4,60</td>
<td>4,70</td>
</tr>
<tr>
<td>Variance</td>
<td>3,82</td>
<td>4,90</td>
</tr>
<tr>
<td>N</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>p-value</td>
<td>0,725</td>
<td>0,373</td>
</tr>
</tbody>
</table>

n= sample size.

Table 5- Patients answers regarding to dentures bearing.

<table>
<thead>
<tr>
<th>Answer</th>
<th>Group A</th>
<th>Group B</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad</td>
<td>25%</td>
<td>0%</td>
<td>0,017</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>35%</td>
<td>30%</td>
<td>0,736</td>
</tr>
<tr>
<td>Very good</td>
<td>40%</td>
<td>70%</td>
<td>0,057</td>
</tr>
</tbody>
</table>

References