

# Selection of mandibular major connector based on a conventional impression technique

Adriana da Fonte Porto Carreiro<sup>1</sup>, Arcelino Farias Neto<sup>2</sup>,  
Brunna Moreira de Farias Pereira<sup>3</sup>, Luana Maria Martins de Aquino<sup>2</sup>

<sup>1</sup>DDS, MS, PhD, Professor, Department of Dentistry, Federal University of Rio Grande do Norte, Natal (RN), Brazil

<sup>2</sup>DDS, MS, Graduate student, Department of Dentistry, Federal University of Rio Grande do Norte, Natal (RN), Brazil

<sup>3</sup>DDS, Graduate student, Department of Dentistry, Federal University of Rio Grande do Norte, Natal (RN), Brazil

## Abstract

The selection of the mandibular major connector of a removable partial prosthesis depends on the distance between the floor of the mouth and free gingival margin, height of the lingual frenum, presence of mandibular tuberosity, mobility of anterior teeth, major connector used in a previous denture and patient's opinion, slope and retentivity of alveolar bone. However, the dental technician rather than the dentist often selects the major connector in the cast model. **Aim:** To determine whether there is a difference between selecting the mandibular major connector clinically or in the cast model as determined by a conventional impression technique using alginate and a universal metallic tray. **Methods:** The sample was composed of 64 patients under treatment at the Department of Dentistry of the Federal University of Rio Grande do Norte. The distance between the floor of the mouth and the free gingival margin of the remaining elements was measured with a millimeter periodontal probe in the oral cavity and in the cast models. **Results:** The mean clinical distance between the free gingival margin and the floor of the mouth was  $7.39 \pm 2.13$  mm, in contrast to the mean distance found in the models ( $9.03 \pm 1.36$ ). The Mann-Whitney test showed a significant difference ( $p < 0.001$ ) between the two measures. **Conclusions:** For the adequate selection of the mandibular major connector, the distance between the gingival margin and the floor of the mouth must be measured clinically when using the conventional impression technique.

**Keywords:** removable partial prosthesis, mandible, planning.

## Introduction

The fabrication of removable partial dentures (RPDs) is one of the most affected areas of dentistry with the absence of sound scientific criteria, given that innumerable framework designs can be correctly performed for a same case. According to Owall *et al.*<sup>1</sup>, current planning principles are not based on clinical studies and, consequently lack scientific evidence, although this does not mean that they are incorrect.

One of the few components where there seems to be universal consensus in terms of its selection is the major bar lingual connector, which should be used whenever possible, owing to its advantages in hygiene and comfort<sup>2-5</sup>. It requires a minimum space of 8 mm between the free gingival margin of the anterior teeth and the mobile floor of the mouth (myohyoid and genioglossus muscles). Four millimeters of this distance is needed for the occlusal-gingival diameter of the bar, a space that ensures rigidity and avoids flexion and fibromucosa trauma. The other 4 mm refer to the distance that the upper bar must remain from the gingival margin<sup>5</sup>. However, some authors reported that this distance can be even shorter, that is, only 3 mm<sup>2</sup> or even 2 mm<sup>4,6</sup> from the free gingival margin.

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### Correspondence to:

Adriana da Fonte Porto Carreiro  
Av. Alexandrino de Alencar, 1384/14 Tirol.  
CEP 52015-350 - Natal-RN, Brazil  
E-mail: adrianadafonte@hotmail.com

The distance between the gingival margin and the floor of the mouth can be measured clinically using a periodontal probe and instructing the patients to raise and protrude their tongue until the tip reaches the red part of the upper lip. Thus, the floor of the mouth becomes active and raises the tissues to the maximum height that they attain during mastication. Once the measure is obtained, it is transferred to the diagnostic cast model<sup>7</sup>.

When there is not enough space for the lingual bar, because the mobile tissues of the floor of the mouth are very high or the ridge height is reduced due to advanced periodontal problems, the choice will be the lingual plate<sup>6</sup>. The lingual plate allows a higher placement of the lower border without compromising rigidity, in addition to not damaging the gum, owing to the greater relief permitted. However, its upper limit is established at the cingulum level of the anterior teeth, covering the entire area corresponding to the marginal gingival. Thus, it is believed that this covering hinders the flow of saliva, oral self-cleaning and the physiological stimulus of gingival tissues promoted by the tongue in this area. Studies have shown that patients with a lingual plate exhibited greater plaque accumulation on the lingual surface of the anterior teeth than those with a lingual bar, even with professional supervision<sup>8-9</sup>. Thus, when the lingual plate is used, the patient no longer enjoys the benefits of the lingual bar.

On the other hand, an improperly chosen lingual bar may cause a series of problems, such as trauma to the floor of the mouth tissues, displacement during mastication, undue covering of the free marginal gingival, difficult hygienization, greater plaque accumulation and periodontal problems. Therefore, the correct measurement of the available space is crucial in selecting the mandibular major connector. However, given the large number of cast models that are sent to the prosthetic laboratory without any type of planning<sup>10-14</sup>, it is often observed that this measure is not obtained clinically, but rather in the cast model by the dental prosthetic technician, sometimes resulting in an incorrect selection.

The aim of the present study was to determine whether there is a difference between the clinical selection of a major mandibular selector and the selection made in the cast model.

## Material and methods

The present study was conducted at the Department of Dentistry of the Federal University of Rio Grande do Norte, Brazil after approval by the local Ethics Research Committee (protocol n<sup>o</sup> 095/05) and all patients signed a written informed consent form. The sample consisted of 64 randomly selected patients who were in the final process of RPD installation in the Partial Removable and Integrated Clinic disciplines. All the metallic frameworks were made in cast models obtained from the alginate mold and type IV plaster (Durone; Dentsply, Petrópolis, RJ, Brazil). Clinical evaluation of the distance between the marginal gingival and the floor of the mouth was performed using a periodontal probe and instructing the patients to open mouth and to elevate and protrude their tongues until the tip reached the red part of the upper lip. The same tongue movement was performed during

impression with metallic stock trays to obtain the cast model. One measure was carried out for each tooth (from 35 to 45), if they were present, measuring the free gingival margin at its most apical point, at the bottom of the floor of mouth. The smallest measure and its location were recorded, serving as a reference for taking a single measurement of the cast model and for comparing the values. Descriptive data analysis was conducted using the mean and standard deviation and SPSS 16.0 software. The Mann-Whitney test was applied to evaluate the relationship between the study variables. The significant level was set at 5%.

## Results

The mean distance found clinically between the free gingival margin and the floor of the mouth was 7.39 mm, whereas in the models this distance was 9.03 mm. This difference was statistically significant ( $p < 0.0001$ ) (table 1).

**Table 1** - Distance (mm) between the floor of the mouth and the free gingival margin (Mean and Standard deviation).

Measurement	N		
Clinical	64	7.39	2.13
Cast Model	64	9.03	1.36

## Discussion

In addition to replacing lost structures, the main goal of rehabilitation with a RPD is to preserve and protect the remaining structures<sup>4</sup>. However, dentists are reluctant to plan RPD, possibly due to their lack of knowledge, and thus, many errors occur in the selection of the mandibular major connector<sup>15</sup>. On average, 90% of cast models are sent to the laboratory without any type of dental preparation or planning. Rather, the responsibility falls on the dental prosthesis technician, who does not have the required knowledge to perform this task, a situation that leads to high failure rates and periodontal complications<sup>10-14</sup>.

Clinical studies show that the lingual bar is the most widely used type of connector in RPD<sup>16-19</sup>. The examination of 200 patients with RPD showed that this connector was used in 77% of inferior prostheses<sup>18</sup>. Another study, with a sample of 25 patients with lower RPD found 96% with a lingual bar, and a lingual plate in only one patient, due to mobility in the pillar teeth. However, the mean distance between the superior border of the bar and the gingival margin found by the authors was only 2.82 mm<sup>19</sup>. According to Carr et al.<sup>5</sup>, this distance should be at least 4 mm to maintain oral hygiene and gingival health. Review of the literature shows no consensus regarding the ideal distance. Most authors believe that 3 mm is sufficient, although even a distance of 2 mm would be acceptable<sup>2,4,6</sup>. Considering a mean distance of 3 mm and adding to it the 4 mm corresponding to the diameter of the occlusal-gingival of the bar, a space of at least 7 mm would be necessary between the gingival margin and the floor of the mouth for a lingual bar to be indicated. In the present study, it was observed that only 59.3% of the patients met this clinical criterion. A similar result was found in a study with 80 partially

edentulous patients free of periodontal disease, where this proportion was 60%<sup>20</sup>. If the 8 mm suggested by Carr *et al.*<sup>5</sup> were considered, this indication would be even more restricted, to only 48.4% of our sample. On the other hand, when the measures obtained in the models are used, 95.3% (7 mm) or 82.8% (8 mm) would be indicated to receive the lingual bar.

Thus, comparison of the data indicating a lingual bar obtained in the model and in the mouth between one another and with those of frequency of use observed in other studies<sup>18-19</sup> suggests that this type of connector is being improperly indicated, likely resulting from the laboratory selection made by the dental prosthesis technician. When the measures obtained clinically were compared to those of the cast models, a significant difference was observed between the two groups ( $p < 0.0001$ ). A review of the literature did not find any study with a similar methodology. The difference between the measures of the two groups was 2.36 mm, which is a value high enough to cause errors in the selection of the inferior major connector. The highest mean was found for the measurements performed in the plaster model. Although the patients were instructed to elevate and protrude their tongues until the tip reached the red part of the upper lip during impression, this result may be due to the displacement of the floor of the mouth caused by the alginate or by insufficient tongue movement during impression, given that the gingival margin was relatively adhered to the dental surface, and did not suffer displacement. Also there is the possibility that the inner border of the tray touched the floor of the mouth avoiding its upward shift. Thus, the error will likely occur in the determination of the lower limit of major connector positioning. Perhaps, a custom-made tray would have been useful since it can be adjusted prior to impression.

These findings suggest that those who perform the measurements in cast models are systematically incurring the risk of selecting a lingual bar that clinically invades the functional space of the soft tissues of the floor of the mouth, a situation that may provoke trauma or displacement of the RPD. Furthermore, the need to adjust the RPD, due to patient complaints, may wear and weaken the bar. Zavanelli *et al.*<sup>19</sup> report that in case of incorrect selection, compression from the major connector on the tissues may result in local inflammation, gingival retraction, pain, bone loss and dental mobility, compromising the patient-professional relationship and discrediting the prosthetic rehabilitation treatment. Thus, it is evident that for the proper selection of the mandibular major connector the distance between the marginal gingival and the floor of the mouth must be obtained clinically. Dentists must show greater commitment during the fabrication of RPD in the sense of carefully planning their cases, thereby avoiding sending cast models to the dental prosthesis laboratory without any orientation or planning.

The present results show that for the correct selection of the mandibular major connector it is essential that the distance between the marginal gingival and the floor of the mouth be measured in the oral cavity.

The distance from the floor of the mouth to the free gingival margin of the remaining teeth is essential for the

selection of mandibular major connector. Considering the results of the present study, the reviewed literature and the issues discussed above, it seems reasonable to conclude that the impression technique used in this study to obtain a cast model does not offer an accurate measurement of space, leaving to the dentist and not to the dental prosthesis technician the decision for the type of mandibular major connector to be chosen.

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