Evaluation of Senior Brazilian Dental Students About Mouth Preparation and Removable Partial Denture Design


Abstract: This study aimed to evaluate the knowledge of senior dental students about mouth preparation and removable partial denture (RPD) design. Two hundred sixty-six senior students from eleven dental schools in the State of São Paulo, Brazil, comprised the sample. The subjects examined two partially edentulous casts mounted on a semiadjustable articulator, answered a questionnaire regarding the treatment plan, and drew the RPD design. The casts consisted of Kennedy Class III, modification 1 maxillary arch and Class II mandibular arch. Ninety percent of the students believed that mouth preparation should be performed although no one was able to name all necessary procedures. For the maxillary arch, 12 percent of the denture designs were completely appropriate, 51 percent were partially appropriate, and 37 percent were inappropriate. For the mandibular arch, the results were 3 percent, 40 percent, and 57 percent, respectively.

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Treatment with removable partial dentures (RPD) must focus on restoration of occlusal function and esthetics with no damage to the remaining teeth and supporting tissues. Therefore, mouth preparation is necessary to provide adequate support, stability, retention, and a harmonious occlusion for the RPD without leading to deleterious force to the abutment teeth and periodontal tissues.¹ Mouth preparation consists of six steps in chronological order: establish occlusal plane; recontour proximal surfaces of posterior teeth; recontour proximal surfaces of anterior teeth; recontour facial and lingual surfaces of teeth; fabricate rest preparations; and smooth and polish all altered surfaces.²

The quality of prescriptions and the fabrication of RPDs by general dental practitioners worldwide frequently fail to comply with ethical and legal requirements.³ Studies have reported that dentists are often negligent with fundamental principles for the construction of RPD, and in many countries, impressions and master casts for RPDs are frequently sent to dental laboratories without mouth preparation and written instructions of design information. The number of cobalt-chromium RPDs constructed by dental laboratories without any written communication of the design may be higher than 90 percent.⁴⁻¹⁰

The Brazilian Ministry of Education and Culture recommends that dental schools graduate general practitioners who are able to attend to the community’s oral health care needs. Thus, knowledge about denture construction must be acquired by the dental student during predoctoral education. However, there has been no correlation established between the didactic and clinical instruction of RPDs and the inappropriate behavior of dentists regarding this treatment modality. Two hypotheses may explain this issue: dentists may disregard the knowledge acquired in an attempt to save time and expedite treatment, or
dentists may receive inadequate instruction during dental school.

It is important to investigate if the discrepancy between the principles for RPD construction described in the literature and the realities of clinical practice is due to inadequate education programs during dental school. The aim of this study was to evaluate the knowledge of senior dental students about mouth preparation and RPD design.

Material and Methods

Senior students (n=266) from eleven dental schools from the state of São Paulo, Brazil, volunteered to accomplish a cross-sectional survey. The study was approved by the Research Ethics Committee of Bauru Dental School (no. 129/04). Schools included (two public and nine private schools) were randomly selected from forty-seven dental schools in São Paulo. Class size ranged from forty-eight to eighty students. All students in the final year were invited to join the sample, yielding an acceptance rate of 40 percent. The undergraduate curriculum of Brazilian dental schools encompasses theoretical, laboratory (including the use of the surveyor), and clinical teaching with the intent of making the student able to plan, design, execute, and follow-up RPD (both acrylic and cobalt-chromium based dentures) according to the prosthodontic principles, concepts, and practices of the Academy of Prosthodontics. Preclinical and clinical teaching ranges from three to four academic semesters, but the first semester is generally dedicated to preclinical learning. The books most used are Henderson and Steffel, Fiori, and Zanetti and Laganá.

The subjects were asked to examine two partially edentulous casts mounted on a semiadjustable articulator (Figure 1). The students then answered a questionnaire in essay form regarding mouth preparation (Table 1) and designed the RPD framework design on dental charts of the partially edentulous arches. It was also possible to write out in words any additional explanation about denture design. The maxillary cast consisted of a Kennedy Class III, modification 1. The missing teeth numbers were 1, 3, 4, 13, 14, and 16. Tooth number 2 was mesially inclined (Figure 1B), and tooth number 15 was extruded (Figure 1C). The mandibular arch consisted of a Class II, and the missing teeth numbers were 17, 18, 19, 20, 31, and 32.

The completed questionnaires were evaluated by the same examiner. Mouth preparation and denture design were classified as completely appropriate, partially appropriate, or inappropriate (Table 2). The denture design was evaluated according to the philosophy and principles of the Removable Partial Denture Discipline from Bauru Dental School. Since many designs may be adequate for the same situation, the design was considered correct if it provided sup-
port, stability, and retention with no damage to the remaining teeth and periodontal tissues.\(^1\) Examples of adequate design features included single palatal bar, circumferential clasps on 5, 2, 12, and 15 with rests located close to the edentulous space, and minor connectors connected to the saddle for the maxillary arch (Figure 2) and mandibular bar, embrasure clasp on 29 and 30, I-bar clasp with reciprocal arm and mesial rest on 21, indirect retainer on 27, and minor connectors connected to the major connector for the mandibular arch (Figure 3). Each design was scored with one point for each group of components correctly planned (major connector, minor connector, rest, retainer). The quality of the design was assessed by the total score (Table 2).

### Results

Ninety percent of the students stated that mouth preparation should be performed, while 5 percent said “no” and 5 percent “maybe.” No student successfully listed all necessary procedures to be accomplished during this treatment phase. Seventy-two percent partially answered the question, while 27 percent had inappropriate responses and 1 percent did not answer this question.

Twenty-three students demonstrated an inadequate understanding of mouth preparation. For the maxillary arch, 12 percent of RPD designs were evaluated to be completely appropriate, 51 percent partially appropriate, and 37 percent inappropriate. For the mandibular arch, the results were 3 percent, 40 percent, and 57 percent, respectively. It was therefore surprising that 56 percent of the student volunteers said that they were confident and competent to design RPDs.

### Discussion

Senior dental students were recruited from dental schools from the State of São Paulo, which has the majority of dental schools in Brazil. A representative sample of senior dental students from 23 percent of the dental schools from the State of São Paulo was included in this study.

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**Table 2. Assessment of mouth preparation and denture design**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Mouth Preparation</th>
<th>Denture Design (score)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completely appropriate</td>
<td>Occlusal adjustment (15), guiding plane (2), and rest seats</td>
<td>4</td>
</tr>
<tr>
<td>Partially appropriate</td>
<td>At least one of the procedures mentioned above</td>
<td>2–3</td>
</tr>
<tr>
<td>Inappropriate</td>
<td>None of the procedures needed</td>
<td>0–1</td>
</tr>
</tbody>
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**Figure 2. Maxillary framework design: circumferential clasps on direct abutment teeth (5, 2, 12, 15) to provide direct retention**

**Figure 3. Mandibular framework design: I-bar clasp on 21 provides direct retention; cingulum rest (27) and embrasure clasp (29, 30) provide indirect retention; nonretentive clasps on 29 to not create a Class 1 lever and avoid risk of deactivation of clasps; retentive buccal clasp on 30**

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The suboptimal knowledge about treatment of partially edentulous patients with RPD therapy was verified in this study. This is a serious problem that has already been observed in several investigations of clinicians’ attitudes and abilities.4-10 In clinical practice, this results in the absence of mouth preparation on master casts and inadequate treatment planning and prosthesis planning, which often results in RPD frameworks being designed by dental laboratory technicians. This problem seems to be worldwide, since it has been reported in developing countries such as South Africa and Kingdom of Bahrain,10 as well as developed countries such as the United Kingdom,4 Canada,5 Sweden,6 Ireland,7 and the United States.8

Hummel et al. estimated that only one-third of the RPDs worn by the adult population were considered adequate.15

Mouth preparation is a series of procedures that aims to repair, modify, or protect the remaining teeth. It is accomplished with the purpose of eliminating or redirecting adverse forces that may be deleterious to the abutment teeth and periodontal tissues and to provide retention and support for the RPD for a long time. Mouth preparation is divided into two phases. The first phase, called general mouth preparation, is responsible for the reestablishment of the hard and soft tissue health. The second phase, tooth preparation, improves the biomechanics of the remaining teeth, making them able to receive the RPD framework.1 This study evaluated the students’ knowledge about tooth preparation by means of a questionnaire based on the analysis of the casts mounted on a semi-adjustable articulator. This scenario did not include the diagnostic variables of periodontal disease, caries, or periapical pathology. Furthermore, it was not possible to survey the casts. Mouth preparation was classified as completely adequate if it comprised at least the procedures that could be determined to be necessary by visual examination and were evident without the use of the surveyor: preparation of rest seats, reestablishment of the occlusal plane due to the extrusion of tooth number 15 by occlusal adjustment (or root canal therapy and a crown), and preparation of guiding plane due to the mesial inclination of tooth number 2. Extraction of tooth number 15 was not indicated since it was sound and its extraction would turn the maxillary arch into a Kennedy Class II.

Ninety percent of the students stated that mouth preparation should be performed; however, no mouth preparation outcome was evaluated to be completely adequate. Rest seat preparation is widely accepted to be an important aspect of treatment in Brazilian schools and has also been identified as the most common procedure in seventeen English dental schools.16 These reports are inconsistent with observations from clinical practice. Previous studies have shown that dentists rarely do any preparatory intraoral procedure prior to making the definitive impression for the RPD prosthesis before sending the cast to the dental laboratory. This situation does not appear to have changed over time.4,9,17

According to data from the last epidemiological assessment of Brazilians’ oral health, accomplished by the Ministry of Health in 2003, 85 percent of the Brazilian adult population wears or needs some kind of dental prosthesis.18 It was also observed that the need for prosthetic treatment is associated with socioeconomic factors. There is a great need for RPD treatment to be supplied not only by prosthodontists but also by competent general dentists since it is an appropriate treatment for partial edentulism and offers a less expensive option of prosthetic treatment than implant-assisted restorations. However, most general practitioners neglect fundamental RPD principles and transfer the responsibility for planning the prosthesis to dental laboratory technicians.4,10 The reason for this is not clear. A previous study found that educational factors seem to have a more significant effect on this issue than financial factors.3 Another study revealed that the majority of dentists are conscious that success will be positively influenced if they design the RPD, but only half reported that they did this in their practice.19

Due to the possibility of many adequate RPD designs for the same partially edentulous patient, it is possible for a clinician to become insecure about the survey and design process, especially in face of the complexity of factors that must be considered. Consequently, the dentist may choose to delegate this responsibility to a dental laboratory. It is interesting to note that 56 percent of the senior students in this study said that they were confident of their ability to design RPD frameworks independently. This response suggests that they believe that following graduation from dental school they will be providing RPDs of acceptable quality. It can be postulated that these practitioners will not be motivated to improve their skills in this area. If inappropriately designed, planned, or placed, RPDs may have deleterious effects on oral health and supporting structures. Owall et al. have described the potentially harmful effects of inappropriately designed RPDs, such as gingival...
irritation, distribution of lateral forces to abutment teeth, root caries, tooth loss, and low patient satisfaction. In our study, the low percentage of “completely appropriate” designs for both arches (12 percent for maxilla and 3 percent for mandible) is alarming, since these students will soon graduate and probably repeat these inappropriate actions leading to unsuccessful treatment. Most common faults found were absence of rest seat preparation, inadequate maxillary major connector (anterior-posterior palatal bar), distal rest seat and/or circumferential clasp on tooth number 21, absence of indirect retainer to avoid mesial rotation of the free-end saddle, and no embrasure clasp on the side opposite to denture base.

Based on the results of this study, senior students from the eleven surveyed dental schools from the State of São Paulo were not able to accomplish mouth preparation and removable partial denture design. It may be inferred that dental schools are graduating clinicians unable to satisfactorily design the RPD and prescribe the prosthesis to the dental laboratory technician. The didactic education taught in the State of São Paulo dental schools seems to be consistent with the basic principles for construction of RPD prostheses advocated by the Academy of Prosthodontics. Surveying, retention, stability, and support considerations are factors for successful treatment taught in most Brazilian dental schools. In the United States, all dental schools report teaching students to use a surveyor when designing an RPD. However, in some schools the students may graduate without treating at least one partially edentulous patient with an RPD. In Ireland and the United Kingdom, the RPD experience gained by undergraduate dental students is limited and appears to be hampered by limited access to patients suitable for undergraduate teaching. Based on survey results, the didactic basis and treatment requirements for RPD therapy have been taught in dental schools. The problem seems related to providing students with adequate clinical experience in the dental school environment that will in turn carry into the practice of dentistry.

It can be concluded that the majority of the senior dental students from the State of São Paulo are not able to provide adequate RPD treatment. The available evidence suggests that immediate changes in the teaching of RPD are necessary with an emphasis on the treatment planning, mouth preparation, and survey and design principles. Senior dental students should also clearly understand the distinction between the clinician’s and dental technician’s responsibilities. The synergistic interaction of the dentist and the laboratory technician will significantly contribute to successful removable partial denture treatment.

REFERENCES