ASSESSMENT OF THE STRUCTURAL COMPONENTS OF REMOVABLE PARTIAL DENTURES

ABSTRACT

AIM: The aim of this study was to assess the mechanical and planning failures of the structural components of tooth-supported and tooth-mucosa-supported removable partial dentures (RPDs). **MATERIAL AND METHODS:** We evaluated the following components of fifty removable partial dentures: direct retainers (niche, support, retention arm, opposition arm, position on the abutments, type of retainers selected), indirect retainers (position, necessity, and niche), acrylic saddle, major connector, insertion axis and interference of muscles and nerves, which were classified into adequate and inadequate. **RESULTS:** There was a statistically significant difference between tooth-supported and tooth-mucosa-supported dentures when the major connector was considered. **CONCLUSION:** The major component failures were the following, in descending order: maintenance of the prosthesis, niche, insertion axis, and acrylic base.

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KEYWORDS

Removable partial denture. Planning. Prosthesis failure.

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INTRODUCTION

Chewing is one of the most important functions of the stomatognathic system, which helps digestion by grinding food and providing a stimulus to salivation[1]. Dentition must be healthy and balanced for the masticatory system to work in complete harmony. However, many times it is severely damaged by decay, gum disease or trauma. Therefore, it is necessary to re-enable it, restoring aesthetics, masticatory efficiency and phonetics, without impairing muscles and joints, and bringing comfort to the patient.

Dentists should have good knowledge of the stomatognathic system and technical materials to making a dental prosthesis. The final quality of a prosthesis depends on a critical clinical work and correct planning to get good retention, stability and balanced occlusion[2].

Removable partial dentures are even more complex because the prosthetic structure will depend on the abutment teeth, which, consequently, can have their periodontal insertion or mineral structure impaired. Planning depends on a physiological analysis of the occlusal condition of the patient, as well as the direction of the forces that the teeth will bear, and the insertion axis, which should be parallel.

Removable partial dentures are commonly said to be inefficient, harmful to the soft and hard tissues, as well as uncomfortable and unaesthetic[3]. This is due to the fact that many dentists just make molds for the patients and entrust the task of designing and planning to the prosthetist[4,5], without any prior preparation.

Vieira and Todescan[6] (1972) stated that inadequate planning of a removable partial denture might become the most costly way to extract a tooth. That way, it is possible to understand why such prostheses have the lowest acceptance rate among patients.

The aim of this study was to assess the mechanical and planning failures of the structural components of tooth-supported and tooth-mucosa-supported removable partial dentures.

MATERIAL AND METHODS

For this study, 50 patients attending the dental clinic at the University of Southern Santa Catarina (UNISUL) who used removable partial dentures made elsewhere were randomly selected. The Research Ethics Committee of UNISUL has approved the study.

After receiving prophylaxis, the patients were classified according to Kennedy's classification system, and the removable dentures were analyzed by three previously calibrated investigators (Table 1), totaling 29 tooth-supported and 21 tooth-mucosa-supported prostheses.

Data were recorded in an evaluation form and rated as appropriate or

inappropriate (Table 2). Then, they were exported to Microsoft Excel® software. The Chi-square test was performed to verify possible statistically significant differences ($p<0.05$) between tooth-supported and tooth-mucosa-supported prostheses.

Table 1. Assessment information of removable partial dentures.

VARIABLES ANALYZED	EVALUATION CRITERIA
Direct retainer	(1) Presence or absence of niches; (2) opposition, support and retaining arms; (3) position of retainer in relation to abutments; (4) types of retainer according to each case.
Indirect retainer	(1) Position of retainers; (2) necessity; (3) presence or absence of niches.
Acrylic saddle*	(1) In the edentulous area or not; (2) compression of the soft tissue.
Major connector*	(1) Connector Type; (2) compression of the soft tissue.
Insertion axis	(1) One or more than one
Interference of muscles and nerves**	(1) Present or absent
Prosthesis maintenance	(1) Adequate or inadequate.

* With the prosthesis adapted to the abutment teeth, the edentulous area was evaluated for a possible soft tissue injury caused by compression. **We instructed the patients to perform movements with cheeks, lips and tongue to check for interference of muscles and nerves.

Table 2. Ideal characteristics of the components of removable partial dentures.

VARIABLE	GOLD STANDARD
Prosthetic abutment	Each tooth adjacent to a prosthetic space must have a clamp.
Anterior prosthetic abutment	Accepts semi-circumferential clamp and end action (free end).
Intermediate abutment (premolar)	Accepts half-half and Ottolenghi-type clamps.
Posterior abutment (premolar)	Accepts circumferential and semi-circumferential clamps, and end action (free end).
Posterior abutment (molar)	Accepts circumferential clamp, end action (free end) and ring clamps (inclined abutments).
Type of major connector	(1) Upper: U bar or simple palatine for tooth-supported prostheses and double palatine bar for tooth-mucosa-supported prostheses; (2) Lower: Simple lingual bar for tooth-supported prostheses and simple lingual bar with or without Kennedy's continuous bar for tooth-mucosa-supported prostheses.
Free-end saddle	Must be at opposite ends of the prosthetic space.

RESULTS

Data analysis showed that over 90% of removable partial dentures had failures in at least one of the factors assessed (Figure 1). The maintenances of the prosthesis and indirect retainers were the factors that presented

failures more often (Figures 2 and 3). Table 3 shows the classes of failure encountered throughout this study, in decreasing order of frequency.

When the component parts of the direct and indirect retainers were disregarded, the direct retainer was the factor with the highest percentage of failures, followed by the prosthesis maintenance (Table 4).

There was a statistically significant difference ($p<0.005$) between tooth-supported and tooth-mucosa-supported only when major connectors were evaluated (Figure 4).

Figure 1. Reviewed removable partial dentures.

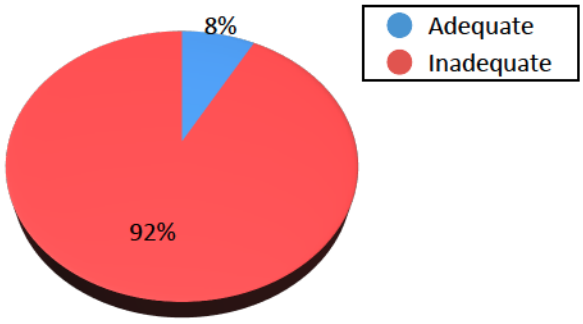


Figure 2. Maintenances of removable partial dentures.

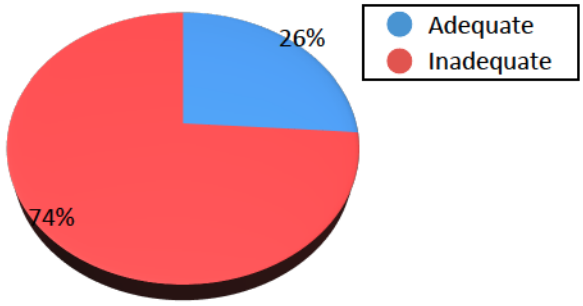
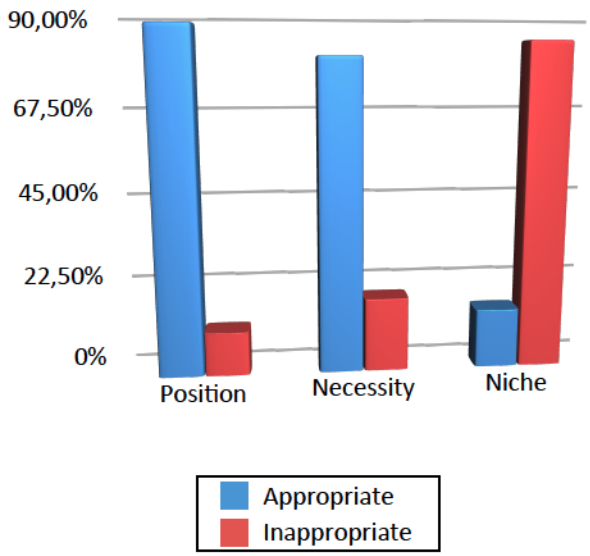


Figure 3. Failures concerning the indirect retainer (position, necessity and niche).



DISCUSSION

Based on the results of this study, tooth-mucosa-supported partial removable dentures had statistically significant difference when compared to tooth-supported prostheses. Such a disparity can be explained because the former requires greater complexity of planning, especially with regard to the type of major connector[7], which is supported by other previous studies[7-10].

Any failure in the components of removable dentures may show negligence on the part of dentists in relation to fundamental biomechanical principles[7-10]. Neto et al.[8] (2010) have raised two possible scenarios in order to elucidate the neglect: (a) clinical contempt of the acquired knowledge, or (b) poor training in the undergraduate education[9]. According to Allen et al.[11] (2008), despite the awareness that planning is a critical factor for

achieving success, most dentists disregard this step.

Table 3. Distribution of prosthetic failures according to Kennedy's classification.

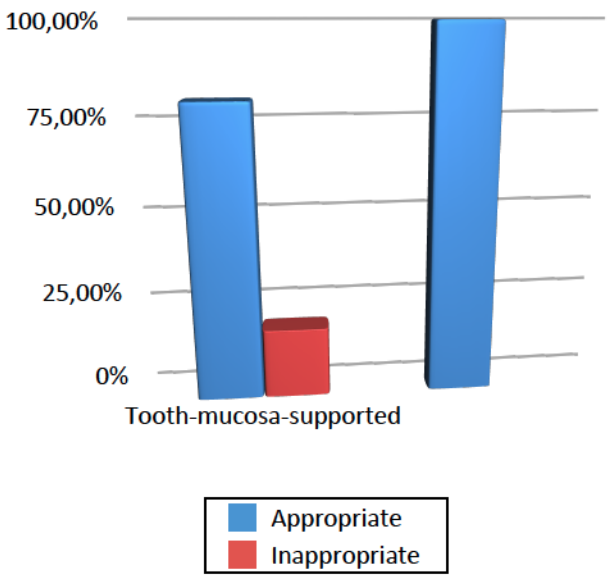
Kennedy's classification	RPDs	%
III	26	52
I	17	34
II	4	8
IV	3	6

Table 4. Failure percent of the components.

COMPONENTS	FAILURES	%
Direct retainer	44	88
Maintenance	37	74
Insertion axis	23	46
Acrylic saddle	20	40
Major connector	16	32
Indirect retainer	13	26
Interference of muscles and nerves	12	24

Previous studies have indicated that the manufacture of more than 90% of removable partial dentures occurs without any written communication between the dentist and prosthetist[12,13]. It is well known that a satisfactory final work is only obtained through good communication, schematic drawings on the template photocopy, written instructions, and three-dimensional design in the plaster model[14]. According to Koyama et al. [15] (2010), factors such as age, location of the edentulous areas, number of antagonist teeth, number of supports, artificial color of teeth, and presence of pain associated with the use of a prosthesis significantly affect the continued use of removable dentures. Moreover, planning and careful execution of removable dentures are vital for comfort, health and confidence of the patient[16].

Figure 4. Comparison between tooth-mucosa-supported and tooth-supported removable partial dentures when the type of major connector was evaluated.



Assessment of the previous preparation of tooth structure for prosthesis revealed that over 80% of patients showed no clinical intervention. Biomechanically, the supports ensured the distribution of forces against the abutment teeth, providing support and stability to the prosthesis. However, the lack of suitable niche sockets is responsible for predisposing the patient to occlusal interference. Rice et al.[17] (2011) have shown that only 30% of dentists refer the model to the laboratory with the correct preparation of the niche sockets. Most of the working models revealed an inadequate size of abutments with insufficient interocclusal space.

With regard to prosthetic maintenance, 74% of cases were inadequate, either by the lack of orientation on the part of the dentist or by the lack of compliance with the recommendations of dentists on the part of the patients. Regular consultations should reduce the consequences of poor oral hygiene and minimize the negative potential that dentures may present to oral health, such as increased plaque, gingivitis, and higher incidence of root caries[18].

Our findings reinforced those published by Schwarz and Barsby[19] (1984) in the mid 80s regarding the insertion axis. The design of models ensures not only a single axis of insertion and removal of the prosthesis, but avoids unnecessary tooth structure wear, providing good stability and retention[10,20].

Thus, a visual inspection cannot reliably indicate the undercuts of the direct locking arm, which most often leads to poorly adapted clamps with high possibility of fracture and distortion, pain and mobility of the abutment teeth[21,22]. However, bestowing the diagnostic function to the laboratory is a violation of the Dental Code of Ethics. Diagnosis, treatment plan and execution are exclusive functions of dentists[23].

CONCLUSION

Despite the limitations of the study, there was a high rate of inadequate removable prosthetic works. Given that life expectancy is increasing, and tooth loss is gradually decreasing, the prevalence of partially dentate adults tends to rise, therefore, increasing the relevance of this rehabilitative option.

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