Design of Removable Partial Dentures: A Survey of Dental Laboratories in Greece

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The aim of this study was to compare data on design and fabrication methods of removable partial dentures (RPDs) in two major cities in Greece. A questionnaire was sent to 150 randomly selected dental technicians. The participation rate was 79.3%. The anterior palatal strap, the lingual bar, and the Roach-type clasp arm designs were preferred. Half of the RPDs fabricated were retained using precision attachments. Differences between the two cities were observed in types of major maxillary connectors used, types of attachments and impression materials used, as well as the design of distal-extension RPDs. Postdoctoral education was found to have an impact on RPD fabrication. Despite the differences observed, design and fabrication of RPDs followed commonly used principles. *Int J Prosthodont 2012;25:66–69.*

Removable partial dentures (RPDs) represent a significant proportion of prostheses used in patients over 65 years of age in developed countries.[1] There are countries where one-third up to one-half of the elderly population uses such prostheses. It is anticipated that the need for RPDs will increase in the coming years.

A decrease in usage and condition of RPDs was presented in the literature as a consequence of duration of use. Problems associated with RPDs may be in part attributed to errors in design or fabrication.

In 1962, McCracken presented one of the first studies that evaluated design parameters of RPDs.[2] In the years that followed, many studies were published describing differences in design in countries such as Sweden, the United States, Canada, Ireland, Great Britain, Germany, and Thailand by means of questionnaires or cast analysis.

Limited data are available on the design and fabrication of RPDs and the involvement of the dental laboratories in Greece. Thus, the aims of this study were to collect data and to investigate differences between two major cities in Greece concerning the design and fabrication of RPDs by means of a questionnaire and an interview. Differences between general dentists and prosthodontists were also evaluated.

Materials and Methods

The study population consisted of 150 randomly selected (Randomness 1.5.2, Andrew Merenbach) dental technicians from 700 members of the Dental Technicians Association in two major Greek cities (100 from Athens, 50 from Thessaloniki).

A questionnaire was designed combining questions from previous similar surveys. The questionnaire included questions on the design process and fabrication of RPDs and was sent to the study population.

Statistical analysis was accomplished using Statistica software (StarSoft). Analysis of variance, multivariate analysis of variance, Spearman correlation, and chi-square tests were used for city and group comparisons. A P value ≤ .05 was considered to suggest statistical significance.

Ethical approval was obtained for this study (Committee of Dental School, UOA 22.01.2009).

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Table 1 Results of Survey Questions on RPD Design

	Total (mean, %)
RPD design is completed:	
By the dentist	3.0
By the dental technician	38.0
With the collaboration of dentist and technician	59.0
Communication between dentist and technician is done by:	
Written instructions	31.7
Telephone instructions	33.5
Surveyed and designed master cast from the dentist	13.5
Direct communication between dentist and technician	21.3
Given instructions concerned:	
The design of the major connector	7.9
The design of the direct retainers	18.4
The design of the rest positions	9.9
The design of the major connector and direct retainers	16.5
The analytic design of all elements	36.2
Not given instructions	11.1

Table 2 Frequency of Major Connectors in the Maxilla and Mandible

	Total	Athens	Thessaloniki	*P**
Maxilla				
Anterior palatal strap	41.6	32.4	61.3	< .001
Palatal plate	24.3	25.6	21.6	NS
Posterior palatal strap	19.0	17.4	22.4	NS
Anteroposterior palatal strap	12.0	9.5	17.8	NS
U-shaped (horseshoe) palatal strap	12.0	12.0	12.7	NS
Mandible				
Lingual bar	76.7	75.3	79.7	NS
Lingual plate	13.0	13.4	12.1	NS
Double lingual bar	5.4	3.2	10.1	NS
Dental bar	3.0	2.2	4.7	NS
Cingulum bar	1.0	1.0	1.3	NS
Sublingual bar	0.0	0.0	0.0	NS
Labial bar	0.0	0.0	0.0	NS
Swing-lock	0.0	0.0	0.0	NS

NS = not significant.
*Comparison made between cities, multivariate analysis of variance.

Table 3 Frequency of Direct Retainer Types

	Total	Athens	Thessaloniki	*P**
Attachments				
ERA	13.0	14.1	10.6	NS
Ball	19.2	8.6	41.7	< .001
Dalbo	19.0	20.9	15.0	NS
Ceka	41.4	34.5	56.1	< .001
Distal-extension hinges	0.4	0.2	0.8	NS
Intracoronal attachment	1.4	1.1	2.1	NS
Hader bar and clip	4.4	2.9	7.8	NS
Other	24.0	11.2	51.0	< .001
Clasps				
Cast circumferential	26.6	24.8	30.5	NS
Rest plate I-bar	11.5	10.6	13.5	NS
Other Roach type (rest plate T- or L-bar)	53.5	50.9	59.0	NS
Rest plate A-bar	3.0	2.8	2.5	NS
Combination clasp (wrought wire)	5.8	2.0	13.9	< .001
Back action	6.3	5.1	8.9	NS
Other (mesial, distal, grip, ring)	3.5	2.6	5.6	NS

NS = not significant.
*Comparison made between cities, multivariate analysis of variance.

Table 4 Frequency of Distal-Extension RPD Design

	Total	Athens	Thessaloniki	*P**
Occlusally approaching clasps	38.7	37.5	41.3	NS
Gingivally approaching clasps	64.2	62.2	68.7	NS
Mesial rest seats	63.3	74.0	40.4	< .001
Distal rest seats	36.7	24.0	63.8	< .001
No rest seats	4.8	2.0	10.6	NS

NS = not significant.
*Comparison made between cities, multivariate analysis of variance.

Results

Data were collected over a period of 4 months (February to May 2009). The participation rate was 79.3% (119 of 150 questionnaires). The most important results are presented in Tables 1 to 6.

In this study, Kennedy Class I (approximately 50%) and II (approximately 22%) RPDs were the most commonly constructed in both arches. It was observed that RPD design was not sufficiently completed by the dentist; 67.4% of dentists used custom trays for the definitive impression but border molding was only occasionally used (Table 5).

Irreversible hydrocolloid was the most frequently used impression material in Athens (44.3%), compared to polyvinyl siloxane in Thessaloniki (52.3%) (Table 5). Statistically significant differences were found between the two cities concerning type of major maxillary connector used ($F = 8.136$, $P < .001$), type of attachments used ($F = 26.735$, $P < .001$), and rest positions in distal-extension RPDs ($F = 61.83$, $P < .001$) (Tables 2 to 4).

Table 5 Results Acquired for RPD Impression Procedures and Materials (Mean ± Standard Deviation)

	Total	Athens	Thessaloniki	*P**
Impression procedures				
Definitive impression made using a custom tray (%)	67.4 ± 28.9	65.1 ± 29.4	71.2 ± 27.8	NS
Impressions of edentulous regions made using the border molding technique (%)	26.7 ± 28.7	24.6 ± 25.9	31.1 ± 34.0	NS
Frequency of impression materials				
Polyvinyl siloxane	42.9 ± 30.1	38.5 ± 29.0	52.3 ± 30.8	NS
Polyether	15.2 ± 24.8	10.9 ± 19.1	24.5 ± 32.5	NS
Irreversible hydrocolloid	34.3 ± 31.1	44.3 ± 31.4	12.9 ± 16.6	< .001
Other	3.7 ± 13.6	3.2 ± 12.0	4.8 ± 16.8	NS

NS = not significant.
*Comparison made between cities, multivariate analysis of variance.

Table 6 Results of Survery Questions on RPD Fabrication Procedures

	Total (%)
Type of articulator used for the articulation of the master casts	
Standard values	31.0
Semiadjustable	50.0
Not specific	18.0
Other	1.0
The articulation of the maxillary cast is done:	
With the use of facebow registration	32.0
Arbitrarily	40.0
Other	28.0
Type of material used for the duplication of master casts	
Duplicating paste	28.6
Silicone	34.9
Paste or silicone	22.2
Reversible hydrocolloid or silicone	11.1
Reversible hydrocolloid	3.2
Type of alloy used for the fabrication of the framework	
Cobalt-chromium alloy	88.6
Titanium alloy	6.7
Other	4.7
Old and new alloys mixed?	
Yes	61.2
No	38.8
Type of casting machine used	
Electronic	73.9
Manual	26.1
Type of flasks used	
Classic	76.5
Silicone	5.9
Plastic	2.0
Unipress	2.0
Ivoclar system	2.0
Combination of the previous	11.6
Altered cast technique used (mean)	13.4
Surveyor used for the blocking of undercuts (mean)	87.2
Attachments used (mean)	52.18

A difference was also observed between general dentists and prosthodontists. Specific phases (design, impression taking) of RPD fabrication were evaluated, and dental technicians observed that specialists were more qualified in general.

The majority of frameworks were constructed from cobalt-chromium alloy (88.6%), with only 6.7% fabricated from titanium alloy. Classic methods of processing, such as conventional heat processing, were preferred, while mixing of old with new alloy was frequent (61.2%) (Table 6).

Discussion

The participation rate (79%) was considered satisfactory. It can be assumed that the construction of fixed prostheses when a final abutment exists as well as the use of implants had an impact on treatment selection and distribution of types of RPDs constructed in Greece. The frequencies of the different RPD parts showed to follow similar design rules as those of other countries.[3,4]

Even though the European Union has characterized partial dentures as medical devices and emphasized that they must be designed by dentists and fabricated by dental technicians (MDD 93/42/EEC), data recorded in this study did not confirm the described practice.

In this study, the differences recorded between the two cities could be attributed to differences in education offered by the two dental schools (University of Athens and Aristotle University of Thessaloniki). Data on RPD fabrication presented a rather conventional philosophy and lack of updating in new techniques and materials. The relatively small number of RPDs constructed per year in a dental laboratory (approximately 150) could explain the reason for not investing in new technology, which can be expensive. Differences between general dentists and prosthodontists could assume the role of advanced education in this field, as shown in other studies.[5]

A similar study for the evaluation of RPD design among dentists could provide additional valuable information and comparative data.

Conclusions

This study provided valuable information on several aspects of RPD design and fabrication in Greece. Within its limitations, the following can be concluded: in general, the design followed common principles with those of other countries, statistically significant differences were observed between the two cities, the application of new materials and methods on framework fabrication was limited, and postdoctoral education played a significant role in RPD construction.

Acknowledgment

The authors would like to extend their gratitude to the dental laboratory technicians who participated in the study. Their help is considered invaluable.

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Literature Abstract

Sex differences in destructive periodontal disease: Exploring the biologic basis

This review examines the evidence for a biologic basis of sexual dimorphism in the prevalence and severity of destructive periodontal disease. A narrative review of the literature related to sexual dimorphism in pathogen-mediated inflammatory diseases and immune responses was retrieved from searches of computed databases (MEDLINE, PubMed, and SCOPUS). Of the 221 publications yielded, 37 review articles and their corresponding references were examined. Sex steroids were found to exert profound effects on multiple immunologic parameters regulating the amplification and resolution of inflammation. Strong evidence exists for sexual dimorphism in both innate and adaptive immunity, accounting for differences in immune response and host susceptibility. Injury and infection have been associated with higher levels of inflammatory cytokines (including interleukin 1β and tumor necrosis factor α) in men than women, accounting for sex-specific differences in periodontitis. A heightened innate immune response in men compared to women might contribute to sex differences in the risk of developing periodontal disease. Strong evidence also suggests sexual differences in humoral immunity, with women exhibiting a heightened B lymphocytic activation and antibody production in response to antigens compared to men. The more effective humoral immune response may afford women greater protection to microbial pathogens. Differential gene regulation, particularly in sex steroid–responsive genes, may contribute to sexual dimorphism in susceptibility to destructive periodontal disease.

Widmann G, Zangerl A, Keiler M, Stoffner R, Bale R, Puelacher W. *Clin Oral Implants Res* 2010;21:835–841. **References:** 44. **Reprints:** Dr Gerlig Widmann, SIP–Department for Microinvasive Therapy Department of Radiology Innsbruck Medical University Anichstrasse 35, A-6020 Innsbruck, Austria. Fax: +43-512-504-2758—*Arthur S.K. Sham, Hong Kong*