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RESEARCH ARTICLE

Removable Partial Denture Design in Dental Practice: Epidemiological Study in The Region of Rabat-Sale-Kenitra (Part 1)

Amina Elqarfaoui, Mohamed Nidal Laoufi, Nadia Merzouk, Anissa Regragui

Faculty of dentistry, Mohammed V University Rabat, Morocco. Mohammed-Jazouli, Madinat Al Irfane, BP 6212, Rabat-Instituts, Maroc.

ABSTRACT

Introduction: Despite the enrichment of our therapeutic panoply by integrating implants and CAD/CAM techniques, the removable partial denture with metallic infrastructure (RPD) will remain an unavoidable alternative in the rehabilitation of partial edentulous teeth. The purpose of this survey, divided into three parts, is to evaluate the knowledge, attitudes, and practices of dentists in private practice in the Rabat-Sale-Kenitra region regarding the design of removable partial dentures, to provide information on the means of communication with laboratory technicians, and to investigate possible correlations between the failure of the prosthetic project and certain adopted practices.

Materials and methods: The study concerned a sample of 101 dentists practicing in the region of Rabat-Sale-Kenitra to whom we sent an anonymous 4-page printed questionnaire containing 28 questions on the design of metal frames in PAPM. A descriptive and analytical statistical study was conducted to process the data.

Results: Following the results of the statistical study, only 8% of the practitioners performed more than ten partial removable prostheses per month, 17% did not perform a clinical examination, 20% did not perform a study model, 69% did not perform the RPD design by themselves and entrusted this task to the dental technician. In comparison, 89% did not use a Dental Surveyor.

Conclusion: This survey showed that many practitioners do not follow the rules of good practice and that they lack knowledge of RPD design. Therefore, postgraduate training is envisaged to eventually help practitioners implement these good practices and improve this knowledge. However, it was noted that only 58% of the practitioners in our sample were interested in such training.

KEYWORDS: Removable Partial Denture-Design partial edentulous.

Correspondence: Dr Amina Elqarfaoui, Address : Removable prosthesis resident. Department of removable prosthodontics, Faculty of dentistry, Mohammed V University Rabat. Email: drelqarfaoui@gmail.com

INTRODUCTION

Several studies conducted worldwide indicate that the need for the management of partially dentate adults will increase in the future despite the high level of oral hygiene awareness and access to dental care. A removable partial denture (RPD) is only one of the many options available to treat partial edentulous. Despite the development of implant-supported prostheses, it will remain an unavoidable alternative in the rehabilitation of partial edentulous teeth.

Indeed, for anatomical, medical, or economic reasons, the removable partial denture with metallic infrastructure (RPD) is the ideal treatment for a large number of patients for aesthetic and functional rehabilitation. [1]

For many edentulous patients, the RPD remains a relatively inexpensive, non-invasive, not bulky, and more comfortable treatment option due to its metal base's rigidity and thin-section strength. [2] [3]

Nevertheless, the removable prosthesis is still feared by some patients because of its removability. It is frequently considered to be involved in carious and periodontal diseases or mobility of the abutment teeth. Moreover, it's also criticized by some practitioners poorly inclined to prescribe or perform this type of rehabilitation. [4]

The success of this prosthetic rehabilitation depends on a prosthetic design adapted to each clinical case. The definition of the edentulous class and its problematic, the synthesis of the data collected during the clinical

examination and the complementary examinations, particularly the study models, makes it possible to determine the design adapted to the clinical situation and plan the pre-prosthetic interventions to be carried out. [5]
Whether the design is conventional or computer-assisted, it must meet the fundamental biological and biomechanical principles which are unchanged: to provide each component of the prosthesis with the function to be fulfilled in the forces distribution and the solicitation of the dento-periodontal and osteo-mucosal support surfaces without breaking the physiological balance of these support structures. [2] [6]
Therefore, the objective of this cross-sectional study was to determine the frequency of prescription of RPDs in dental practices in the Rabat-Sale-Kenitra region, to prioritize the types of major connectors and complexity according to the edentulous class, and to assess the knowledge of dentists regarding the design of removable partial dentures.

MATERIALS AND METHODS

Design of the survey questionnaire

This is a descriptive and analytical cross-sectional epidemiological study conducted using a questionnaire. The questionnaire consisted of 28 questions, including six questions on the personal and professional data of the practitioner and his practice. The remainder of the questionnaire was concerned with the practitioner's practices in the design of the metal framework as well as his knowledge of clasps and spacing rules.

Inclusion and exclusion criteria

The study included general dentists practicing in the private sector in the Rabat-Sale-Kenitra region and listed in the official list of the Order of Dentists. Dentists practicing an exclusive specialty were excluded from the sample.

Sample

The target population of our survey was dentists in the private sector in the Rabat-Sale-Kenitra region who are on the official list of the Order of Dentists. We used two types of questionnaires: the first on paper and the second digital via Google Forms.

Survey period

The survey period was from 23/09/2019 to 29/11/2019 during which we were able to collect 101 responses.

Data processing and analysis

- The statistical analysis was carried out using the "Statistical Package for Social Science (SPSS) version 13.0" software. The variables studied were qualitative and expressed in numbers and percentages (%)
- Graphs were made using Microsoft Office Excel 2016.
- The tests used are the Chi-square test or Fisher's exact test. The difference is considered statistically significant if the p-value is less than 0.05

DESCRIPTIVE RESULTS

General characteristics of the sample

In our study, there were 49 men (48%) and 52 women (52%) (Graph 1).
- 63 dentists were between 25 and 40 years old (62%),
- 27 were between 40 and 55 years old (27%)
- 11 were over 55 years old (11%) (Graph 2).

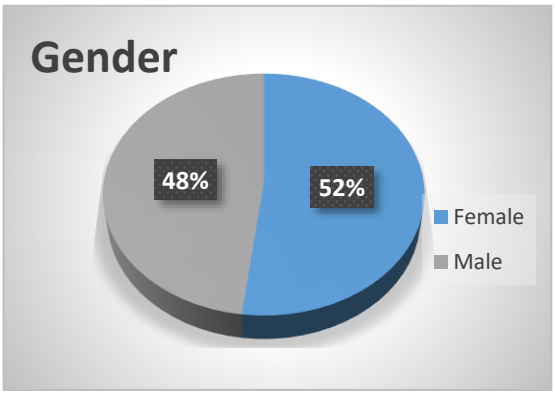
Graph 3 shows the different colleges where the dentists interviewed studied. The college with the largest number of dentists was the Faculty of Dentistry in Rabat (40%).

The rest of the practitioners were trained in the following colleges:
- 17% at the Faculty of Dentistry of Casablanca.
- 14% studied in France.
- 10% in Tunisia at the Faculty of Dentistry of Monastir.
- 7% in Ukraine.
- 6% at the Cheikh Anta Diop Dakar University, Senegal.
- 4% in Russia.
- 2% in Romania.

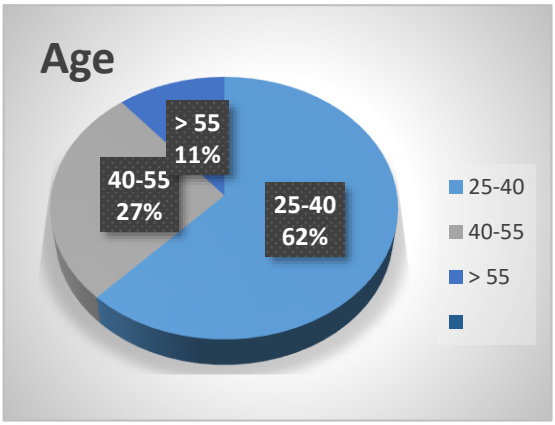
In **Graph 4**, we have sorted the practitioners according to the number of years in practice:
- 59% of practitioners have less than 10 years of experience.
- 26% have between 10 and 20 years of experience.
- 15% have more than 20 years of experience.

Regarding the percentage of study participants based on their geographic location of exercise, we found that practitioners practicing in urban areas are more represented. Of the 101 practitioners interviewed, 85% work in urban areas, compared to 15% in rural and suburban areas. Out of the population studied, 63% of practitioners practiced alone, and 37% practiced in a group.

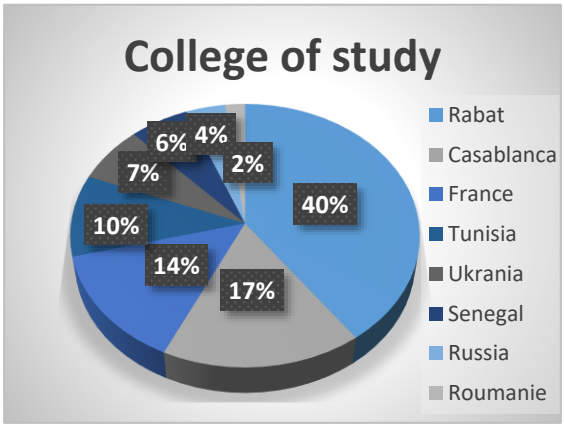
Graph 1: Distribution of dentists according to gender



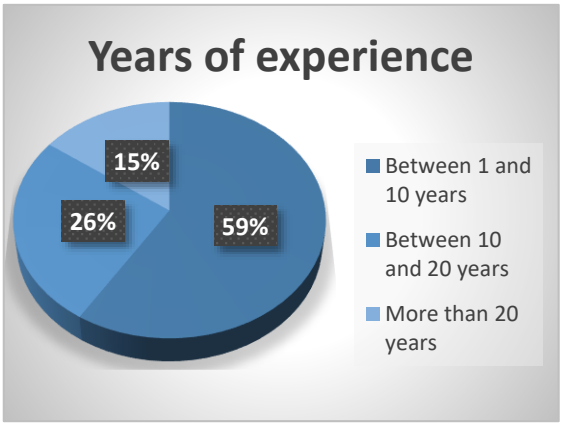
Graph 2: Distribution of the sample according to age



Graph 3: Distribution of Sample by College of study



Graph 4: Distribution of Sample by Years of practice



Information on metal framework design

Graph 5 shows that:

- 74% of practitioners were performing less than 5 partial removable dentures per month.
- 18% performed between 5 and 10.
- 8% performed more than 10

According to the practitioners interviewed, the main reasons for their patients to choose a prosthetic treatment with a metallic partial removable prosthesis are shown in graph 6:

- Its financial affordability with a percentage of 56% **(reason1)**
- The general health of the patients contraindicating long sessions, anesthesia, or implant placement with a percentage of 22 % **(reason 2)**
- Patients refusing root canal treatment of their teeth and preparation for a fixed prosthesis accounted for 19 % **(reason 3)**
- Patients who preferred an easy-to-clean solution accounted for 3% **(reason 4)**

Dentists were asked which class of edentulism was most common in their patients. Of the 101 dentists surveyed, 5 did not respond. The results of the remaining 96 practitioners:

- 33% treated more class I,
- 26% class II,
- 20% class III,
- 8% class IV,
- 6% class V,
- 7% class VI. **(Graph 7)**

The most commonly used maxillary major connectors: **(Graph 8)**

- 40% of the questioned practitioners indicate palatal bar most often,
- 12% for the single palatal strap,
- 12%for the double palatal bar,
- 10% for the full palate connector,
- 26% for the U shaped connector.

One copy was received without a response.

The most frequently used major mandibular connectors: **(Graph 9)**

- 67% of the practitioners surveyed indicated the lingual bar most often,
- 24% of the lingual band,
- 9% the cingular band.

Again, one copy was received with no response.

Informations about Practitioners' knowledge

The first question was the type of clasps that practitioners advocated for use in the bilateral distal edentulous. Four practitioners did not answer this question. For the rest

- 48% of the practitioners answered Back-Action clasp
- 38% Ackers clasp
- 14% Ring clasp **(Graph 10)**

The second question was the type of clasps that practitioners recommended for use in Class IV edentulous cases. Again, four practitioners did not respond. For the rest:

- 38% of practitioners responded Ackers clasp.
- 36% Multiple clasp.
- 26% Embrasure clasp **(Graph 11)**

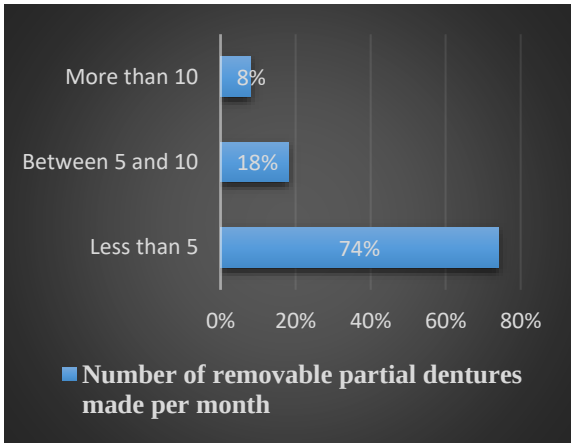
The third question regarding the knowledge of the practitioners concerned gingiva spacing

In the maxilla and mandible.

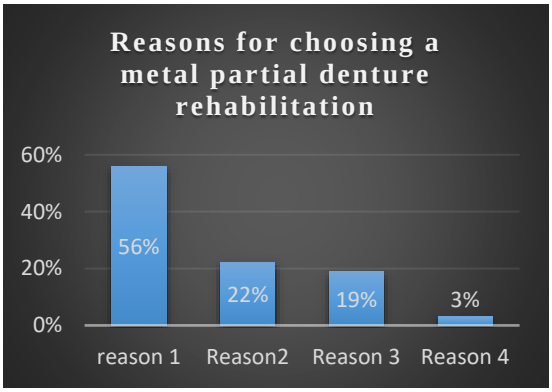
21 copies were received with no response. The remaining practitioner's responded as follows:

- A spacing of 5 mm in the maxilla and 3 mm in the mandible with 38%.
- 5 mm maxillary and 5 mm mandibular spacing with 32%.
- A spacing of 3 mm in the maxilla and 3 mm in the mandible with 18%.
- A spacing of 3 mm in the maxilla and 5 mm in the mandible with 11% **(Graph 12)**

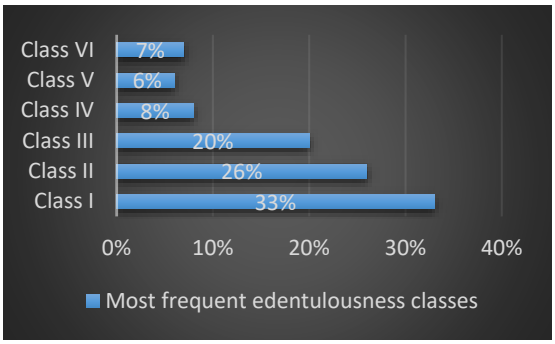
Graph5: Number of removable partial dentures made per month



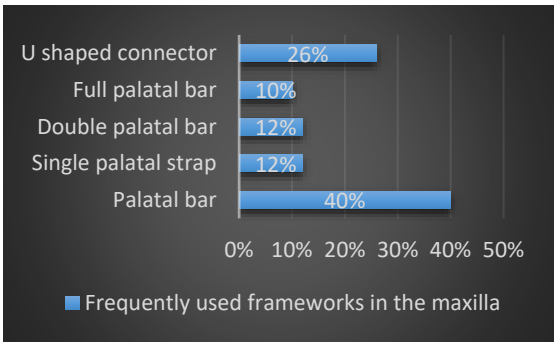
Graph 6: Reasons for choosing metal partial denture rehabilitation



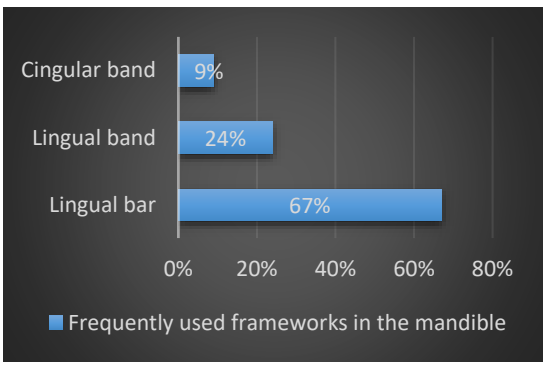
Graph 7: Most frequent edentulous classes



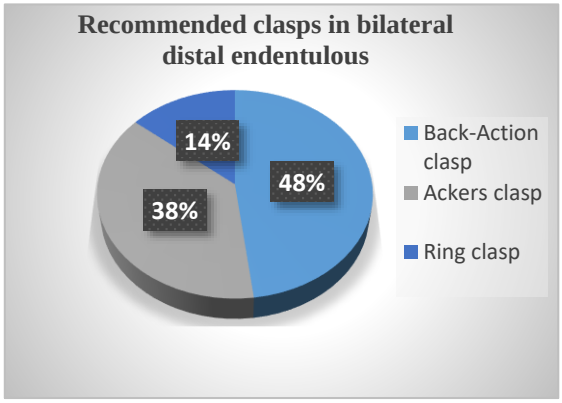
Graph 8: Most frequently used frameworks in the maxilla



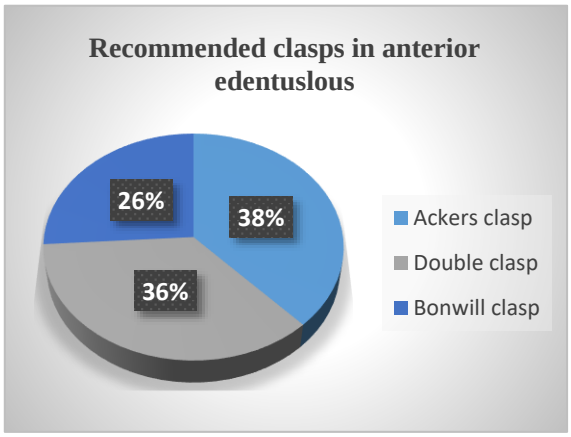
Graph 9: Most frequently used frameworks in the mandible



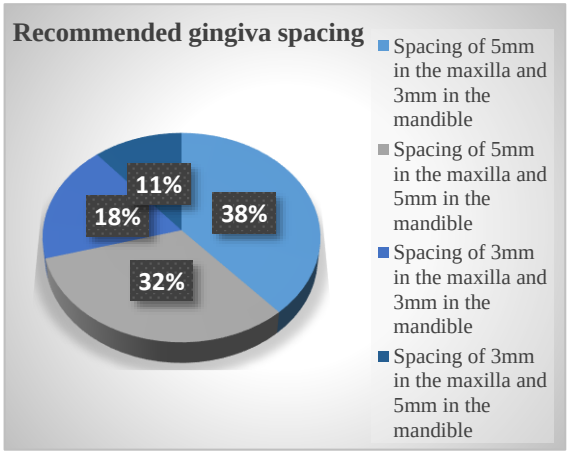
Graph 10: Clasp used in the bilateral distal edentulous



Graph 11: Clasps recommended by the practitioners in anterior edentulous



Graph 12: Practitioners' answers concerning gingiva spacing



RESULTS

Correlation between age and gender

It is interesting to know the relationship between the age of the practitioners and the gender.

We found that 65% of the female dentists were between 25 and 40 years compared to 59% of the male dentists, while only 4% of them were over 55 years compared to 19% of the other gender, and this was statistically insignificant (p=0.058). **(Table 1)**

Correlation between the place of practice /experience and the number of prostheses performed

We wondered if the number of prostheses performed per month might differ by practice location or practitioner experience.

We observe that the percentage of practitioners who performed between 5 and 10 prostheses per month and those who served more than 10 prostheses per month is higher among practitioners practicing in suburban and rural areas. This is a statistically non-significant way (p=0.131). We found that 70% of the practitioners with experience between 1 and 10 years performed less than 5 prostheses per month, in contrast to 85% of the practitioners with experience between 10 and 20 years and 73% of the practitioners with more than 20 years of experience, this is a statistically non-significant way (p=0.626). **(Table 2)**

Correlation between practice location and patients' reasons for RPD rehabilitation

We were also interested in the relationship between practice and why patients opt for prosthetic rehabilitation with an RPD.

We observed that 61% of patients whose practitioners practiced in peri-urban and rural areas opted for prosthetic rehabilitation by partial removable prosthesis because of its affordability, compared to 54% of patients whose practitioners practiced in the city, and this in a statistically non-significant manner (p=0.834) **(Table 3)**

Correlation between the practitioner knowledge and number of prostheses performed / experience/ college of studies

We were interested in the relationship between the number of RDPs performed per month and the questions based on the practitioners' knowledge by analyzing the answers regarding gingiva spacing and the type of clasps used in the bilateral distal edentulous.

39% of the practitioners who performed less than 5 RDPs per month answered that the gingiva spacing should be 5 mm in the maxilla and 3 mm in the mandible, against 35% for those who performed between 5 and 10 RDPs per month and 40% for those who performed more than 10 RDPs per month. This is statistically insignificant (p=0.43).

We found that 39% of the practitioners who performed less than 5 RDPs per month answered that the type of clasp to be used in the bilateral distal edentulous was the Back-Action clasp, compared to 41% for those who performed between 5 and 10 RDPs per month and 63% for those who performed more than 10 RDPs per month. This is statistically insignificant (p=0.458).

We were interested in the relationship between the college of studies and the practitioners' knowledge by analyzing the answers obtained in terms of gingiva spacing and type of clasp used in the bilateral distal edentulous.

30% of the Moroccan-trained practitioners answered that the gingiva spacing should be 5 mm in the maxilla and 3 mm in the mandible, compared to 40% of the foreign-trained practitioners, in a statistically insignificant way (p=0.455).

37% of the practitioners who studied in Morocco answered that the clasp they recommended for use in the bilateral distal edentulous was the Back-Action clasp, compared to 46% of the practitioners who studied abroad. This was statistically insignificant (p=0.208).

We were interested in the relationship between years of experience and knowledge of the practitioners by analyzing the answers obtained in terms of gingiva spacing and type of clasps used in the bilateral distal edentulous.

42% of the practitioners who had experienced between 1 and 10 years answered that the gingiva spacing should be 5 mm in the maxilla and 3 mm in the mandible, compared to 40% for practitioners who had experienced between 10 and 20 years and 8% for practitioners who had an experience of more than 20 years. This was statistically significant (p=0.02).

45% of the practitioners with 1-10 years of experience answered that the clasp they recommended for use in the bilateral distal edentulous was the Back-Action clasp, compared to 38% for practitioners with 10-20 years of experience and 20% for practitioners with more than 20 years of experience. This was statistically significant (p=0.01) **(Table 4)**

Table 1: Relationship between age and gender

		Age			p
		Between 25 and 40	Between 40 and 55	and 55 Over 55	
Gender	Male	59%	22%	19%	0.058
	Female	65%	31%	4%	

Table 2: Relationship between location/practitioner experience and number of RPD performed

		Number of RPD performed per month			p
		Less than 5	Between 5 and 10	More than 10	
practice location	In town	78%	15%	7%	0,131
	Suburban or Rural	53%	33%	14%	
Years of experience	Between 1 and 10 years	70%	22%	8%	0,626
	Between 10 and 20 years	85%	7%	8%	
	More than 20 years	73%	20%	7%	

Table 3: Relationship between location of practice and patient reasons

		Place of practice		p
		In town	Suburban or rural	
Reasons	affordability of RPDs	54%	61%	0,834
	General health condition contraindicating long sessions, anesthesia, implants	23%	13%	
	Patient refuses root canal treatment of natural teeth and their preparation for a fixed solution	20%	20%	
	Patient prefers an easy-to-clean solution	3%	6%	

Table 4: Relationship between the number of prostheses performed/college/experience and practitioner knowledge

		gingiva spacing		Clasp used in the bilateral distal edentulous	
		5 mm in the maxilla and 3 mm in the mandible	Other answers	Back-Action clasp	Other answers
Number of RDPs performed per month	Less than 5	39%	61%	39%	61%
	Between 5 -10	35%	65%	41%	59%
	More than 10	40%	60%	63%	37%
	p	0,43		0,458	
college of studies	National	30%	70%	37%	63%
	foreign	40%	60%	46%	54%
	p	0,455		0,208	
years of experience	Between 1 and 10 years	42%	58%	45%	55%
	Between 10 and 20 years	20%	80%	38%	62%
	More than 20 years	8%	92%	20%	80%
	p	0,02*		0,01*	

DISCUSSION

The results showed that the majority of the practitioners in our sample were young dentists, with no gender predominance,

A large proportion of the dentists interviewed had graduated in Morocco, and most had been practicing for less than 10 years. A significant difference was noted concerning the place of work since 83% of the practitioners in our sample practiced in the city.

The results concerning the number of removable partial dentures made by dentists per month are impressive: 74% of dentists make less than 5 dentures per month, while only 8% make more than 10. It seems from the results of this study that the dentists practicing in suburban and rural areas perform more removable partial dentures per month than those practicing in urban areas.

According to the practitioners interviewed, there are 4 main reasons why their patients choose a prosthetic treatment with a removable partial denture, 56% make this choice for its financial accessibility, 22% for their general state of health, which contraindicates long sessions, anesthesia, or the placement of implants, 19% of the patients refuse an endodontic therapy and the preparation of a fixed prosthesis, and finally, a minority of patients who prefer an easy-to-clean solution represented 3%.

In this regard, **Gala & al**. Reported in a survey conducted in **Toulouse** in **2013** that 86% of the dentists surveyed performed less than 5 dentures per month. [7]

Another study conducted in **Toulouse** in 2016 shows that the average number of removable partial dentures made per month is 4.2. [8]

A recent study conducted by **Badji & Al** (2020) in **Senegal** to assess the involvement of dental technicians in the design of prostheses showed that 71% of dental technicians perform 1 to 3 prostheses per month. [9]

This is similar to the results of the study conducted in the **U.A.E (2011) by Haj-Ali & Al**, who reported that removable cast prosthesis is one of the least reported services by dental laboratories and has a low proportion compared to fixed prosthesis services. [10]

The same observation was reported by **Bartlett & al**. They found that 36% of **South East of England** dentists do not perform DPRs, 38% place between 1 and 5, and only 9 dentists prescribe more than 16 per year. [11]

The definition of the edentulous class and its problem related to the movements of prosthetic destabilization during the function is an essential step to achieve an adequate design ensuring a good prosthetic balance. [5]

The results reported by the dentists interviewed are relevant, especially about the class of edentulous in their patients. The most common was class 1(33%), class2 (26%), class3 (20%).

This is consistent with the study results conducted by **Nick Polychronakis & al**, which show that the last remaining teeth recorded were maxillary and mandibular anterior teeth, based on the photographs of the master cast received by the laboratories. [12]

Several studies from other countries have indicated that distal edentulous has a significantly higher incidence, especially in the mandible. [13]

NASSANI's study indicates that 92% of the models surveyed have posterior mandibular edentulism, and **Spratley's** study shows that mandibular posterior tooth loss is more frequent than maxillary tooth loss. [13][14]

It should be noted that distally extended edentulous teeth are the most complicated to rehabilitate because of the duality of the depressibility between the abutment teeth and the ridges and all the stability problems that result from this. [15]

In these complex cases, the intra-oral optical impression does not give reliable results, the passage by conventional impressions is recommended, and the digitization of the secondary models will be done at the laboratory by a dental lab scanner. [6]

A major connector is the element of the partial denture that consolidates all other parts. It also plays a role in the transverse stability of the arch by neutralizing the displacement through functional stresses. [16]

According to this study, the vast majority of the practitioners surveyed indicate that the palatal bar is the most frequently used major connector in the maxilla (40%) and the lingual bar in the mandible (67%).

NASSANI reports in his study that the most frequently used major connector types in the mandible are the lingual bar and the lingual plate.

This was also observed in the study by Basker and Al, who report that the most popular major mandibular connectors used in dental practice in the United Kingdom are the lingual bar and the lingual plate. [13] [17]

Another observation that caught our attention was that the practitioners were confronted with different clinical situations to judge their attitudes towards the different difficulties present in certain cases. Their knowledge concerning gingiva spacing and the choice of clasps was evaluated.

The most frequent clasps recommended by dentists in the design of distally extended removable partial dentures were Back Action clasps (48%), followed by Ackers clasps (38%), and finally the Ring clasps (14%).

This contradicts the results of the study performed in Greece. **Polychronakis and al**. Found that the gingivally approaching clasps were the most used clasps in distal extension RPDs (79% and 47.6% in Kennedy Classes I and II, respectively), the percentage of occlusal approaching clasps was 16.6% of all clasp, and the Back action clasps were chosen less frequently for Kennedy Class I (2.9%).[12]

We also assessed practitioners' knowledge based on their years of practice. We found that practitioners with experience between 1 and 10 years answered the gingival spacing and the clasps questions correctly. This shows a lack of knowledge of practitioners regarding the RPD design.

CONCLUSION

Several suggestions can explain this low rate, on the one hand, the complexity of the clinical situations of partially dentate patients, which can be a real challenge for the newly qualified dentist. On the other hand, the specialists of prosthodontics seem to make fewer dental prostheses and to concentrate more on implants, encouraged by the level of sensitization of the patients to the dental care and their opening to the various modalities of treatments (fixed prostheses and implant) The limitations of this study do not justify the low number of DPR performed in private dental practice, and further investigations are needed.

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AUTHORS' CONTRIBUTIONS

The participation of each author corresponds to the criteria of authorship and contributorship emphasized in the Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly work in Medical Journals of the International Committee of Medical Journal Editors. Indeed, all the authors have actively participated in the redaction, the revision of the manuscript, and provided approval for this final revised version.

COMPETING INTERESTS

The authors declare no competing interests with this case.

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None.

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