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Partial Edentulism and Removable Denture Construction: a Frequency Study in Jordanians

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Abstract - *This study aimed to investigate the frequency of different classes of patterns of partial edentulism and the most frequently used design components of conventional cobalt-chromium RPD constructed for patients attending a dental teaching hospital in Jordan. Two- hundred laboratory authorization forms were reviewed. Of the total 200 patients (150 male, 48 females, mean age 44.5 years), 150 patients had both maxillary and mandibular Co-Cr RPDs constructed with a total number of frameworks sums to 350. Kennedy classification was followed to identify the class of partial edentulism. Of the total 350 patterns, Kennedy class III was the most common classification encountered in maxilla (47%) and in the mandible (45%). Among combinations, maxillary Kennedy class III classification opposing mandibular class III was the most common combination (30%). The lingual bar was the most frequently designed major connector (77%), while palatal strap was the most common connector in the maxilla (38%). Significantly ($p<0.05$), patterns with Kennedy class II and III were more frequent among males than females. The most common type of direct retainer used was the circumferential clasp in both maxillary and mandibular RPD's. On the other hand, ring clasps were used three times more frequently in mandibular RPD frameworks compared to maxillary RPD's. The RPI clasp assembly was used in class I and class II situations in 75% of cases more common in the mandible. It is concluded that the variations in construction of RPD design concepts with international studies reflects the influence of teaching philosophy and diversity of faculty members' backgrounds.*

KEY WORDS: Kennedy classification, Maxilla, Mandible, Connector, Modification, Jordan

Introduction

Several studies of trends in removable prosthodontic service showed that the number of complete dentures is declining, the number of removable partial dentures is increasing and the fast growing prosthesis constructed was the combination of maxillary complete denture opposing mandibular removable partial denture[1,2]. This reflects the changes in dental treatments provided which encourage the preservation of natural teeth and the decrease in the number of cases require complete dentures. Removable partial denture treatment should be provided when health benefits to be derived outweigh the risks, inconveniences, or burdens involved [1]. A removable partial denture may be needed to restore the functions of natural teeth and their supporting tissues which have been lost, and preserve the remaining teeth. Denture design should prevent drifting, tilting, and over eruption of the remaining natural teeth, improve distribution of occlusal load, prevent an imbalance in the neuromuscular equilibrium, and generally contribute to the normal function of the stomatognathic system[3].

Several studies showed great variations among dentists in the same country in removable partial denture (RPD) designs as it the case among different regions of the world [3,4]. It is widely accepted that the design of removable partial dentures is a clinical responsibility. However, dentists sometimes fail to observe their responsibility in this regard and instead delegate the task of designing dentures to technicians[5,7,8,9].

The need for creating a classification system for partially edentulous arches is to enable the dentist to clearly communicate to a listener or a reader about the condition of an oral cavity in which missing teeth are to be replaced with a prosthesis[2]. Another benefit of a practical classification system is that it helps in the learning of the fundamentals of design. In treatment planning for partial denture management, we must give considerable thought to the partial denture design which will best replace missing teeth, and which restore dental functions with the least harmful effect on the supporting structures[11].

Despite these principles, there are still wide variations in different parts of the world among clinicians regarding the concepts of removable partial denture designs [5]. But the golden rule is that although there are different schools of thought regarding the appropriate design, the patient should be provided with a prosthesis that preserves the health of what remains.

The aims of this study were to investigate the frequency of different classes of patterns of partial edentulism and the most frequently used designs of conventional cobalt-chromium RPD constructed for patients attending the Prosthetic clinic in a Dental Teaching centre in Jordan University of Science and Technology, Irbid, North Jordan during a period of two years and relate this to the age and sex of the patients. Irbid is the second largest city in the North after the Capital and the dental centre is the only educational centre allocated in the north.

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Materials and Methods

This study was carried out at the educational health center of the Faculty of Dentistry of Jordan University of Science and Technology in North Jordan. The dental services are provided at reduced fee for educational purposes.

Two- hundred laboratory authorization forms for patients who were treated and provided with conventional Co-Cr RPD's by the 5th year undergraduate dental students in the Prosthetic clinic in the Dental Teaching centre of Jordan University of Science and Technology were evaluated. Over a period of 2 years, more than 200 forms were available but transitional acrylic RPD's as well as those of other complex RPD designs were excluded from the study.

Kennedy classification was followed to identify different classes of the pattern of edentulism. Design aspects considered included: classification of pattern of edentulism, type of the major connector, types of direct retainers, the use of indirect retention, and location of rests on abutments in distal extension saddle cases. Dental records were used to obtain age and gender of patients, to find out if any relationship existed between age, sex and the pattern of edentulism. This relationship and its significance was determined using cross tabulation and chi-square statistical analysis.

Results

The 200 laboratory forms evaluated were for 152 male and 48 females, with a mean age of 44.5 years (Table 1). Of the 200 patients, 150 had Co-Cr RPDs in both arches and 50 patients had RPDs constructed in just one arch with a total number of RPD frameworks sums to 350 framework.

As table 2a shows, in both maxillary and mandibular arches, Kennedy class III with or without modifications was the most frequent pattern of partial edentulism (47% in maxilla and 45% in mandible) and Kennedy class IV was the least frequently encountered pattern (10% in maxilla and 7% in mandible).Table 2b shows that the majority of Kennedy class I in both the maxilla and mandible were without modification areas (18/30 in maxilla and 15/25 in mandible) , while there was no significant difference among other classes concerning the distribution of modification areas. At the same time, there was no significant difference ($p>0.05$) between the maxillary and mandibular arches in the frequency of class I and class II patterns.

Regarding the combinations of different classes of partial edentulism in the group of 150 patients who had maxillary and mandibular frameworks constructed, Kennedy class III in the maxilla opposing class III of the mandible was the most common combination in 30%of subjects (45/150), followed by class III in the maxilla opposing class II in the mandible in 20% (30/150) and then by class I of the maxillary arch opposing the same class I of the mandible in 10% (15/150) among the 16 possible combinations.

Table 3 shows that there was a tendency for partial edentulism class to increase from class I to class III in the 25-34 and 35-44 age groups. This is not the case with other age groups. Significantly ($p<0.05$) patterns with Kennedy class II and III were more frequent among males than females.

Table 4 shows that in the lower arch, lingual bar was the most frequently designed major connector (77%), while palatal strap was the most common connector in the upper jaw (38%). Analysis of data suggested that the most common type of direct retainer used was the circumferential clasp in both maxillary and mandibular RPD's. On the other hand, ring clasps were used three times more frequently in mandibular RPD frameworks compared to maxillary RPD's. Gingivally approaching clasps were twice as commonly used to retain mandibular frameworks compared to maxillary RPD prosthesis. The RPI clasp assembly was used in class I and class II situations in 75% of cases more common in the mandible. The use of mesial rests on distal extension abutment teeth was found in 91.3% of cases. Indirect retainers in the form of rests were included in more than 80% of class I mandibular frameworks, with significantly less in the maxilla ($p=0.001$).

Discussion

Several studies of the outcomes of RPD treatment have been performed [6,7,8,9,10]. However, there appears to be no unanimous opinion on RPD design principles. These principles are not based on clinical research and therefore are not evidence based [15].

The results of this study showed that bounded saddles (Class III Kennedy classification) were the most common pattern of edentulism in the different age groups, whereas class IV anterior saddles were the least common pattern observed. This is in agreement with a previous study [6]. However, more males were found to have classes II and III than females. Obviously, no concrete characteristics were found to apply to men or woman as a group. However, females place great value in aesthetics.

Regarding the controversy of RPD design, an earlier study reported that class I and class II RPDs were the most common among mandibular prostheses, [7] while another study found that class III followed by class II RPDs were the most common among maxillary prosthesis[5]. In the present study there was no significant difference between the maxilla and the mandible in the distribution of class I and class II, while class III and class IV were found to be more common in the maxilla.

Attitudes toward dental care and motivation for good oral hygiene may also decline with increasing age. The importance of proper dental care often seems secondary to the problems of deteriorating general health and social changes. Ageing affects the patient's tissue tolerance, oral hygiene, pulp size, muscular coordination, clinical crown length, mental attitude, and salivary flow [13]. Related to this, the results showed that the number of class I and class II did not show any trend to increase with advancing age. This is in contrast to the study done by Sadig & Idown[6].

While in our study, palatal strap major connector was the most frequently used maxillary major connector, other studies showed that the U-shaped [10] and anterior posterior strap [6] were the most commonly used connectors. The palatal strap gives more comfort to the patient because there is less coverage of the highly innervated mucosa of the anterior palate and less obstruction to the tongue [12]. Furthermore, the posterior strap design requires the least

Table 1. *The distribution of the population sample according to their age and sex*

Total N (%)	Female N (%)	Male N (%)	Age group
60 (30)	**15 (7.5)**	**45 (22.5)**	25-34 yrs
75 (37.5)	20 (10)	55 (27.5)	35-44 yrs
50 (25)	10 (5)	40 (20)	45-54 yrs
15 (7.5)	3 (1.5)	12 (6)	55-64 yrs
200 (100)	48 (24)	152 (76)	Total

Table 2a. *Frequency of different classes of partial edentulism according to Kennedy classification (number =350)*

Total N(%)	Class IV N (%)	Class III N (%)	Class II N (%)	Class I N (%)	Arch
193 (100)	20 (10)	91 (47)	52 (27)	30 (16)	Maxilla
157 (100)	12 (7)	70 (45)	50 (32)	25 (16)	Mandible

Table 2b. *Frequency of different classes of partial edentulism according to Kennedy classification and modification areas.*

Class	No Modification area		Anterior modification area		Posterior modification area	
	Max	Man	Max	Man	Max	Man
Class I	18	15	5	6	7	4
Class II	15	17	17	13	20	20
Class III	28	30	31	20	32	20
Class IV	20	12				

Table 3. *Frequency of different classes of partial edentulism according to age and sex of patients*

Age Group	Class I	Class II	Class III	Class IV
25-34	11	17	60	8
35-44	20	40	60	12
45-54	18	27	11	7
55-64	6	28	20	5
Gender				
Male	35	90	100	20
Female	20	12	61	12

Table 4. *Distribution of Major connectors by Kennedy classification*

	Class I	Class II	Class III	Class IV	Total
Maxilla					
Palatal plate	12	20	21	4	57
Palatal strap	5	20	40	8	73
U-shaped palatal strap	3	10	15	6	34
Ant. Post palatal strap	10	2	15	2	29
Total	30	52	91	20	193
Mandible					
Lingual bar	18	35	60	8	121
Lingual plate	7	15	10	4	36
Total	25	50	70	12	157

amount of patient adaptation for speech while variation in mandibular major connector showed little effect on speech patterns. Major connector design does influence the ultimate success of treatment for patients and palatal strap is the most preferred major connector by patients. The findings of this study are in general accordance with previous studies concerning upper major connector design[13, 16].

As it was obvious in this study, palatal strap major connector is better suited for the restoration of short span tooth supported bilateral edentulous areas. It my also be used in tooth-supported unilateral edentulous situation with provision for cross-arch attachments. Width of palatal strap should be confined within the boundaries of supporting rests**.**

In cases of tooth-mucosa supported RPD and where the greater extent of the saddles presents more of a support problem (Kennedy class I modification 1), the functional forces can be shared between teeth and mucosa by utilizing palatal strap major connector that extend posteriorly to the junction of the hard and soft palates and it is still possible to leave the gingival margins of the majority of teeth uncovered.

The lingual bar was found to be the most common lower jaw major connector. The preference for the lingual bar is dependent on the depth of the lingual sulcus, the presence of tori, periodontal disease, and existing dentures [15]. An indirect retainer reduces the risk of the denture base moving away from the supporting tissues [17,18,19]. However a study by Yeung et al., 2000, showed that lifting of the bases occurred despite the provision of indirect retainers [20]. This study showed that indirect retention was used more often in mandibular class I cases than in the maxillary class I frameworks. Indirect retainers are very useful in maxillary RPD treatments to avoid food particles to be 'pumped' under the palatal strap and saddles. This applies for mandibular RPD treatments taking into account the surface area of the mandibular arch and the quality of the supporting structures.

The overwhelming preference for circumferential clasps was found in this study in accordance with a previous study [10]. Occlusaly approaching clasps minimize the risk of gingival trauma. However, their esthetic properties are of concern to the patient. On the other hand plaque formation and unfavorable anatomical factors often mitigate against the use of gingivally approaching clasps[17]. It was noticed that more frequent use of I bar clasp in the maxilla than in the mandible indicates the higher priority for esthetics in the maxilla. On the other hand, the more frequent use of the ring clasp in the mandible than in the maxilla may suggest the higher tendency of finding mesially inclined mandibular terminal molar abutments than in the maxilla.

The prescription of the RPI system was used in 75% of distal extension cases and that is in contrast to a previous study [6]. In this study, an overwhelming use of mesial rests (91.3%) on distal extension abutment teeth was found. During function, rotation occurs around the mesial rest; the I-bar and proximal plate disengage from the tooth and the abutment tooth is usually braced by a mesial adjacent tooth [13,14].

Conclusion

The variation in conventional RPD design concepts among international studies reflects the influence of different teaching philosophy and diversity of faculty members' background. Many RPD design principles are based more on clinical experience than scientific evidence. Under these circumstances, it is advisable when making RPD design principles, to consult the widest possible range of specialists rather than to rely on the views of just one or a few Prosthodontists [19]. The decision whether or not to restore an edentulous area should be based on clear functional indications, the absence of contraindications and on patient preference. Overall, hygienic aspects of RPD design are of over-riding importance compared with design aspects that are concerned primarily with mechanical requirements.

The results of this study proved that the teaching philosophy of partial denture design in faculty of Dentistry, Jordan University of Science and Technology has been effective in teaching the principles of RPD design, criteria for selection of different components of RPD based on hygienic principles, sound biomechanical concepts, preservation of oral health, functions and esthetics

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