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Do Patients Have a Preference for Major Connector Designs?

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Abstract

Aim: The aim of this research was to evaluate patients' preferences for resin analogs of four major connector designs formulated to have equal rigidity once fabricated in the same alloy.

Methods and Materials: Nineteen Kennedy Class I or II partially edentulous patients participated at two centers. The four major connector analogs (MCAs) were fabricated for each subject using light-polymerizing acrylic resin. The subjects were asked to wear each of them in the mouth for 30 seconds in six pairs in random order, and to report their preference for each pair. Based on these data, the four analogs were ranked in a descending preference order for each patient. Within-subject comparisons preferences were performed with the Friedman test, and the multiple comparisons were performed with the Wilcoxon Signed Ranks test for data of each sample independently.

Results: Statistically significant and consistent preference orders were revealed for both samples, and the thin and wide design was significantly preferred to the thick and narrow design. However, a higher variation was observed for the first preference of each subject.

Conclusions: Subjects demonstrated a tendency to prefer thinner MCAs. However, the individual predilections of patients may not be an appropriate basis for an attempt to find a 'best design' applicable to all patients.

Keywords: Removable partial dentures, RPD, major connector design, major connector analog, MCAs

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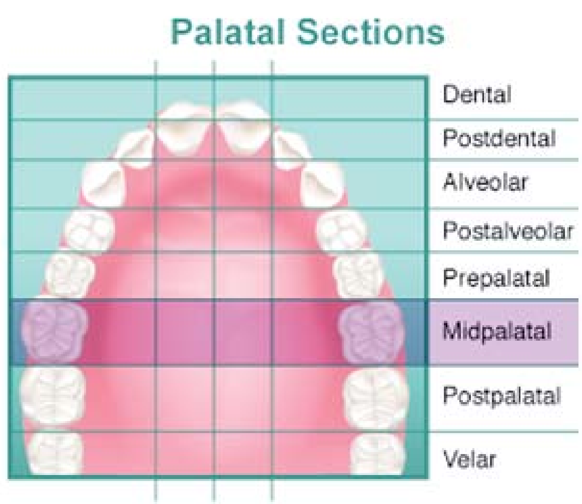
Introduction

The major connectors of removable partial dentures (RPDs) must be efficient in function with minimal interferences with oral functions such as mastication, speech, and deglutition. Several clinical and laboratory studies have been dedicated to the improvement of major connector designs with patient satisfaction and the maintenance of adequate mechanical properties in mind.[1-3] Yet, in practice the design of major connectors exclusively depends on clinicians who focus their efforts on esthetics and on mechanical properties that fulfill the requirements of adequate retention, stability, and masticatory efficiency.[4-8] Regardless of all these advances, some patients are not satisfied even with technically excellent prostheses. This phenomenon is attributed to numerous patient specific psycho-physiological factors.[9-11] Further, the dental literature provides strong evidence that patients respond to different oral devices with preferences to certain designs.[12-14] However, adequate attention has not been given to such predilections regarding the design of RPD major connectors to facilitate an appropriate selection to maximize patients' satisfaction.



The available evidence suggests patients prefer thinner RPD designs.[2] Studies suggest patients express concern about the surface area of the palate being covered by major connectors[2,3] as well as the location of a major connector on the palate with the majority opting for mid-palatal designs.[3] However, the investigators have used arbitrary major connector designs without consideration for possible design variations. Serious reservations about the outcome of these studies exist because the applications of specific designs to the subjects in the studies appear to have significantly biased the results.

The aim of this joint research was to evaluate patients' preferences for four major connector designs fabricated using a finite element analysis to assure equal rigidity when constructed using the same alloy (Table 1).[15] The null-hypothesis tested was there would be no significant difference among patients' preferences to major connector analogs (MCAs) of these four designs constructed using light polymerizing resin and inlay wax.

Methods and Materials

Subjects

Nineteen partially edentulous patients (Kennedy Class I or II) participated in the study. Ten patients (seven women and three men, mean age 59.2 ± 8.9 S.D. years) were recruited at the Department of Removable Prosthodontics, Tokyo Medical and Dental University (Center 1), and nine patients (five women and four men, mean age 49.2 ± 11.5 S.D.) were recruited at the Department of Prosthodontic, Chulalongkorn University, Thailand (Center 2). The inclusion criteria were: (1) presence of Kennedy Class I or II partially edentulous area distal to the first premolar in the maxillary arch, (2) willingness to participate in the study, and (3) presence of good general

Table 1. Dimensional specifications of the four major connector designs formulated by Finite Element Analysis compared with the dimensions of Co-Cr major connector used as the standard.[15]

Ti-6Al-7Nb Designs	Thickness	Width at the Center	Specifications of SR		
			Position of SR	Height	Bottom
Wide	0.8	16	No SR	-	-
2SR	0.8	10	2 SR at the anterior and posterior borders	0.7	3
1SR	0.8	10	1 SR in the middle	0.75	5
Thick	1.0	10	No SR	-	-
Co-Cr (Standard)	0.8	10	No SR	-	-

SR, Strengthening ridge; Wide, wide design; 2SR, design with 2 strengthening ridges; 1SR, design with 1 strengthening ridge; Thick, thick design.

Dimensions are given in mm. (This table is republished with permission from Dr. K. Aridome (2005), Removable Prosthodontics, Tokyo Medical and DentalUniversity, Tokyo, Japan[15].)

health. Patients with orofacial pain conditions, established or confirmed acute dental disease, abnormal jaw movement patterns and joint noise, and mobility of remaining teeth ≥ grade II[16] were excluded. Prosthodontists examined and screened the patients following the above criteria. Informed consent was obtained from patients following recruitment. The study design and the procedure were consistent with the principles of the declaration of Helsinki.

Study Protocol

The same experimental protocol was used at both centers throughout the study. A maxillary impression was taken from each patient using irreversible hydrocolloid impression material, and a definitive cast was made using dental stone. The four designs of MCAs were designated: wide design (wide), design with one strengthening ridge (1SR), design with two strengthening ridges (2SR), and thick design (thick). All MCAs were fabricated on the cast using light-polymerizing acrylic resin and inlay wax (Table 1 and Figure 1).

On a second visit (after two weeks) subjects underwent a single-blind preference assessment test. Subsequently, a brief questionnaire was administered to identify any complications that occurred during the test such as a misfit of the MCA, feeling of nausea and discomfort, and to evaluate whether the patients were truly blind to the appearance of test designs. The time taken to perform the entire procedure was recorded.

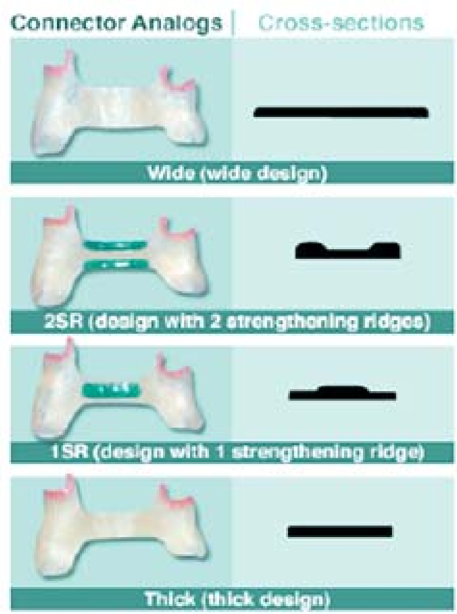


Figure 1. Four MCAs were constructed for a patient with Kennedy Class I partially edentulous maxillary arch. (Wide, wide design; 2SR, design with 2 strengthening ridges; 1SR, design with 1 strengthening ridge; Thick, thick design.) The cross-sections are diagrammatically demonstrated on the right side of each design.

Construction of Major Connector Analogs (MCAs)

MCAs were designed across the interdental papillae of the second premolar and first molar of both sides (Figure 2).

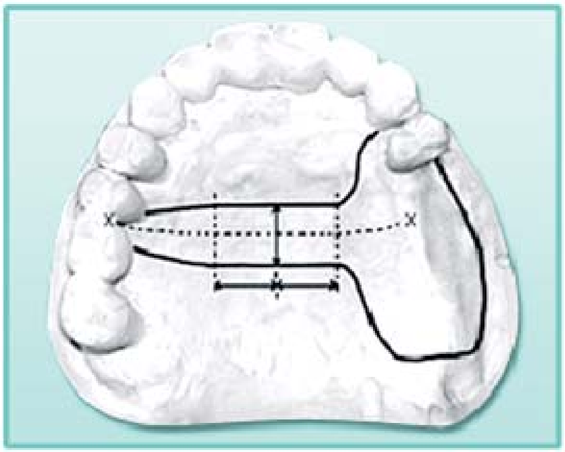


Figure 2. Designed MCA for a patient with Kennedy Class II partially edentulous maxillary arch. The width was maintained from the midline of the resin base to 10 mm on either side of the base (until the dotted lines on both sides).

A 1.5 mm thick light-polymerizing acrylic resin sheet was closely adapted over the cast and cut to a predetermined outline drawn on the cast. This resin base was light cured for ten minutes using a light-curing machine. The thickness throughout the base was measured using a caliper and adjusted to predetermined dimensions by grinding (Table 1).

The specified widths were maintained from the midline of the palate to 10 mm on either side of the resin base. The resin base was smoothed using number '0' sand paper and then polished with polishing paste. Undercut areas were filled with paraffin wax for better retention and convenient insertion. Strengthening ridges were constructed with inlay wax on the polished surface of the resin base. These were extended from the midline of the palate to a distance of 10 mm on either side of the resin base. Final polishing was done with a piece of gauze that applied a smear of wax on the resin plates. The first and second authors constructed MCAs at Centers 1 and 2, respectively, following an agreed upon protocol.

A preliminary study revealed the MCA construction is highly reproducible. Intra-class correlation coefficients for the reproduction of both thickness and width were over 0.90.

Preference Test Procedure

Subjects were seated in a dental chair and given a detailed explanation of the study procedure. The MCAs were checked in the oral cavity of each subject prior to testing to ascertain the degree of fit and retention to the residual ridge and remaining teeth. The four MCAs were given to patients in six combinations of pairs in random order determined by using a random table (short term cross-over design). The subjects were asked to "just retain" and feel each MCA in a pair for 30 seconds. They all answered the question "which one is the preferred design in this pair?" If they were unable to report a difference, both designs were judged to be equal.

Statistical Analysis

Separate analyses were performed with the data obtained from the two centers. Six responses were available for six pairs of the MCAs for each patient. Logical comparison of these six responses (placing the preferred design on the top) allowed the four designs to be placed in a descending rank order of preference for each patient. Three patients of Center 1 had given one conflicting answer each, and these three answers were excluded from the analysis (three out of a total of 60 responses for Center 1); the preference orders were established with the remaining five answers for each of them. "Rank 1" was always assigned to the first preference. A person who was blind to the MCAs and study objectives performed the ranking. Within-subject comparisons of rank orders were performed using the Friedman test (compared the distribution of ranks of each design). The Wilcoxon Signed Ranks test with the Bonferroni adjustment was used for multiple comparisons among the designs.[17] Analyses were performed using the Statistical Package for Social Sciences version 11, designed for windows (SPSS Inc., Chicago, IL, USA). A statistically significant difference was accepted when the p value was less than 0.05.

Results

The average time spent on a patient for the procedure was approximately 25 minutes. None of the subjects complained of lack of retention or misfit of an MCA, nausea, or other complications during the test. No subject was allowed to see any MCA during the test.

The preference order for the four MCAs as established by the Friedman test for both samples are illustrated in Table 2. The multiple comparisons showed the "wide design" significantly ($P<0.004$) and the "1SR design" marginally ($P<0.01$) were preferred to the "thick design" by the patients at

Table 2. Preference orders with mean preference ranks established for study samples at Center 1 and Center 2.

Center 1 (N=10)		Center 2 (N=9)	
Order of preference*	Mean ranks of preference	Order of preference**	Mean ranks of preference
Wide	1.8	Wide	1.6
1SR	2.0	1SR	2.1
2SR	2.6	Thick	2.7
Thick	3.6	2SR	3.6

*, Friedman χ = 11.76 (P<0.008); **, Friedman É‘ = 11.49 (P<0.009).

Wide, wide design; 2SR, design with 2 strengthening ridges; 1SR, design with 1 strengthening ridge; Thick, thick design.

Table 3. Distributions of patients' first preferences for the Center 1 and Center 2.

Design	Center 1 (Number of patients)	Center 2 (Number of patients)
Wide	4	4
2SR	3	1
1SR	3	4
Thick	-	-

Wide, wide design; 2SR, design with 2 strengthening ridges; 1SR, design with 1 strengthening ridge; Thick, thick design.

Center 1. The "wide design" was significantly (P<0.007) preferred to the "2SR design" by the patients at Center 2. No significant difference was observed between the preferences of "2SR" and the "thick" designs for patients of both samples.

A broad variation was observed for individuals' first preferences (the most preferred design of each patient) in both samples, while none of the subjects in either of the centers preferred the thick design as his/her best. The distributions of the first preferences of patients are given in Table 3.

Discussion

The preference orders established for both samples were significant and quite consistent as the "wide" and the "1SR" designs were placed at the first and second positions, respectively. Similar data are not available in the literature for an instant comparison with the present findings. However, these observations are in general agreement with the widely accepted concept by clinicians the thinner major connectors are more comfortable to patients, and also with previous observations the thinner removable dentures cause minimal disturbances to speech.[2,18,19]

Therefore, our null-hypothesis is rejected with confidence while confirming the previous suggestions patients do have a preference for the design of RPD prostheses.[2,20,21] The absence of a significant difference in patients' preferences between the "2SR" and the "thick" designs at both of the centers was quite an inquisitive observation. Due to the presence of two strengthening ridges that left only a 4 mm width of the thin strap between them, it is possible the proprioceptors of the tongue may have perceived it as being a thick design. Our observations also demonstrated a difference in thickness as small as 0.2 mm is clinically significant and alters patient satisfaction.

Despite the relatively consistent preference orders, a high variability was observed for individuals' first preference in relation to both samples. Although this kind of individually specific preference has been reported in the past, this fact has been greatly overlooked in an attempt to find a design satisfactory to all patients.[22] Such a diversity of preferences could be attributed to individual variations of many psycho-physiological factors that may in turn influence a patient's acceptance and satisfaction with their dentures.[23-25] This may at least partly explain why certain patients are unhappy with their prostheses regardless of the technical excellence.[9] A similar systematic approach at least in "difficult denture patients" may enhance the adaptation to new dentures by minimizing unfavorable sensory feedback from the oral cavity. Further, the mere thought of patients that have received the RPD design they expected may help as well. It is also reported patients' involvement in the construction procedure enhances their satisfaction with dentures.[26,27]

Use of major connector designs with controlled dimensions, a highly standardized MCA construction procedure, and the single-blind evaluation of MCA in randomized pairs, where one design is evaluated three times within each test, can be considered as the strengths of the present study. Moreover, in the present study design, each participant serves as his/her own control eliminating the effect of innate characteristics. The power of the study is increased by reducing the number of participants required although the added complexity of analysis is a disadvantage. Further, the very consistent results observed for two samples substantiate the efficiency of the present evaluation system while enhancing the ability to generalize the observations. However, the value of such a short-term preference assessment test might be questioned as an indicator of patients' preferences over a longer time period. While a long-term trial using an RPD in these designs might be the potential study to overcome these problems, such a study is costly and less feasible. Furthermore, results drawn would not be generalized to the population as high individual variation in preference is expected as is reported by this short-term evaluation. Hence, the present study could be considered as a realistic compromise.

Conclusion

There have been numerous reports regarding the Within the limitations, the results suggest there is a general tendency for patients to prefer thinner major connector designs. Further, it may be appropriate for clinicians to select the final major connector design using a similar method as described in this study than forcing an arbitrary design on patients. Such individualized designs might considerably reduce the number of 'difficult denture patients' encountered in dental practice.

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