

## Evaluation of Perceived Acceptability, Beauty and Value of Different Orthodontic Brackets

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### Abstract

**Statement of Problem:** Although different types of aesthetic brackets are introduced to orthodontic profession to reduce the complaints about the metallic braces, little studies have been done to assess patient's views regarding the attractiveness and acceptance of such brackets.

**Objectives:** The goal of this study was to evaluate the perceived acceptability, beauty and value of different orthodontic brackets.

**Materials and Methods:** In a cross-sectional study, three groups of subjects consisting of dental school clinic patients, specialty clinic patients, and art students were interviewed. Sample size was decided 116 in each group. The photographic images of six types of brackets which were placed in an adult mouth were shown to the subjects and they were asked to answer the questions that evaluate attractiveness by visual analog scale (VAS), acceptability of different brackets, and willingness to pay (WTP) for an aesthetic bracket in comparison to a regular bracket. Reliability was measured by giving questionnaires to 20 respondents by a two-week interval. VAS rating was compared by ANOVA. Mann U Whitney and Chi-square tests were used to compare the acceptability between groups when necessary.

**Results:** The reliability measurement results performed by ICC were 0.86 for attractiveness, 0.6 for acceptability, and 0.93 for WTP questions. Lingual brackets had the highest attractiveness rating while metal brackets were considered the lowest aesthetic appliance by all groups of the study. The acceptability of ceramic bracket was highest in all groups. While most appliances evaluated had average acceptability, the large metallic brackets were rated very low. WTP for aesthetic braces was higher in art students than other groups.

**Conclusions:** Lingual brackets were the most attractive but had very low acceptability rate. Small metal brackets had a good acceptability rate. Large metal brackets were the least attractive and had the lowest acceptability. Parents accepted aesthetic brackets for their children even when it cost more.

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### Introduction

Obtaining facial aesthetic is a primary goal of orthodontic treatment [1]. Nowadays, orthodontic patients not only want an improved dento-facial appearance but they also demand a better aesthetic orthodontic appliance during treatment [2]. It is shown that the

view of appliances required during treatment can exert influence on patients' self-esteem and their social interactions [3,4]. The appearance of orthodontic appliances plays a significant role in patient's decisions to undergo orthodontic therapy. Some of the patients might even refuse treatment for this reason [5].

As the patient demands have grown to include aes-

thetic appliances during treatment, efforts have been made to increase the aesthetic quality of orthodontic appliances. In recent years, different types of orthodontic appliance such as lingual braces, plastic brackets, ceramic brackets, and clear plastic tray aligners are introduced to decrease complaint to metallic appliances [6-9]. Although these resources are an esthetic alternative to metal brackets, they also have a number of complications and limitations for routine use in orthodontic treatment [10-13].

Many authors have studied aesthetic aspects of orthodontic appliances [14-17]. Findings of Rosvall's study revealed that adult patients were more willing to accept and pay more money for appliances they consider to be aesthetic [14]. Another study on a Swedish 27 year old adult indicates that 33% of the subjects would not wear visible appliance [4]. Also, child preferences for orthodontic appliances differ from those of adults as enhancing the aesthetics of orthodontic appliances is not an encouraging factor for most children and adolescents to start treatment [15]. A recent study concluded that orthodontic appliance apparently changed the patients' self-perceptions while it did not affect how personal attributes are evaluated by others [16].

The value of orthodontic appliances is another important concern for both patients and practitioners. Among different methods that have proposed to evaluate the economic value of medical and dental interventions, cost-benefit analysis is believed to be the most comprehensive form of economic evaluation [18-20]. In a cost-benefit analysis, willingness to pay (WTP) is used to measure the value of intervention in monetary terms. WTP allows a monetary rating to be attached to any dental care interventions by asking people how much they would spend to get the desired treatment. This value is set as patients are asked to respond to a conditional question such as, "what is the maximum amount you would be willing to pay to have this kind of esthetic orthodontic braces, were it to become available?" WTP questions can be asked in various formats, such as open ended or discrete choice, close ended format.

The perceived attractiveness and value of aesthetic braces is relevant to cultural parameters and might be different between Western and Eastern populations [21]. To our knowledge, no studies in the refereed literature have assessed the esthetic value of orthodontic appliances in any Iranian population. The aims of our study were to evaluate the orthodontic brackets' attractiveness and to determine the range of acceptability of different orthodontic appliances by adult patients and art students in a domestic population. We also assessed the willingness to pay for ceramic brackets with metal wire in comparison to large metal brackets.

## Materials and Methods

The study population of this cross-sectional study consisted of three groups of subjects including pa-

tients attending Shiraz dental school orthodontic clinic, patients attending specialty private dental clinic of Shiraz dental school and students of art faculty of Shiraz University.

In order to calculate the sample size, a pilot study was conducted. 20 subjects were asked to complete the study questionnaires and the resulted data were analyzed to calculate the sample size. A sample of 116 subjects in each group was estimated to be required. ( $\alpha=5\%$ ,  $\beta=20\%$ ). The sample was collected by simple randomization technique and the subjects were selected by generated random numbers from patients/students registry lists.

The questionnaire used in this study was adapted from similar recent studies [14,17]. In the process, the questions were translated into the Farsi language and edited by two language experts. The face validity of the translated questionnaire was evaluated during the pilot study. Face validity was ensured through peer-review and patient feedback sessions. Reliability was measured by giving questionnaires to 20 respondents by a two week interval and data was analyzed by intraclass coefficient correlation. The study subjects were asked to answer the questions after looking at a photo album. The photo album was composed of several pages and in each page a color photo of smile with different kinds of appliances was depicted (Figure 1). The photos of small metal brackets (GAC Microarch), large metal brackets (GAC Ovation), hybrid brackets (Ormco Damon 3), lingual brackets, ceramic (3M Unitek Clarity) with metal wire brackets, ceramic (3M Unitek Clarity) with ceramic wire bonded to the teeth were used. The photos used in this study were adapted from Rosvall's study [14] with the permission of use. Each photo was accompanied by three sets of questions.

The questionnaire consisted of three parts for evaluation of attractiveness, acceptability and value of orthodontic appliances. Visual analog scale (VAS) was used for investigating attractiveness of different orthodontic braces. The VAS scale used was a 10 cm line and the subjects were explained to mark a point on the line to rate the attractiveness of each appliance shown in the photo. The VAS was anchored by the phrases extremely attractive and extremely unattractive.

Yes/No questions were used to assess the acceptability of different appliances. The respondents were asked if they or their child would like to have the shown orthodontic appliances placed on their own or their child's teeth. They were asked to determine if the ones pictured in the album would be acceptable in appearance. The purpose of last question was to determine the perceived value of ceramic bracket in comparison to large metal brackets. The subjects were asked to answer if ceramic brackets are more expensive than large metal ones, and how much money would they like to pay for them extra to the price of large metal brackets which was mentioned in the question.



**Figure 1:** Standardized images of smile with metallic appliances (1,2) ceramic appliances(3,4),hybrid appliance(5) and lingual appliance (14)

Intra-examiner reliability of the VAS ratings was measured by intraclass correlation coefficient (ICC) analysis. Reliability of yes/no responses for acceptability was assessed by the kappa statistic. VAS rating for different kinds of brackets was analyzed by two ways ANOVA; also, VAS rating of brackets in each group was calculated by ANOVA. Post hoc testing was performed by Tukey-LSD and VAS value in males and females was analyzed by Regression. The level of significance was set at 0.05. The data were analyzed using SPSS software (version 19). Acceptability of each bracket in three groups was measured by Chi-square analysis. Acceptability of each bracket between males and females was calculated by Mann U Whitney analysis.

**Results**

The sample’s characteristics are shown in Table 1. Three hundred forty eight subjects participated in this

study; they were evenly distributed in three groups: patients of dental school clinic, patients of specialty private clinic and students of art faculty. In the patient groups, the majority of subjects were female; this reflects the female dominant atmosphere of orthodontic patients. The numbers of female respondents were greater than males in art students too.

**Table 1: Sex distribution of the study groups**

	Female	Male	Sum
Public clinic	73(63%)	43(37%)	116(100%)
Private clinic	89(76.7%)	27(23.3%)	116(100%)
Art student	63(54.3%)	53(45.7%)	116(100%)
sum	225(64.6%)	123(35.4%)	348(100%)

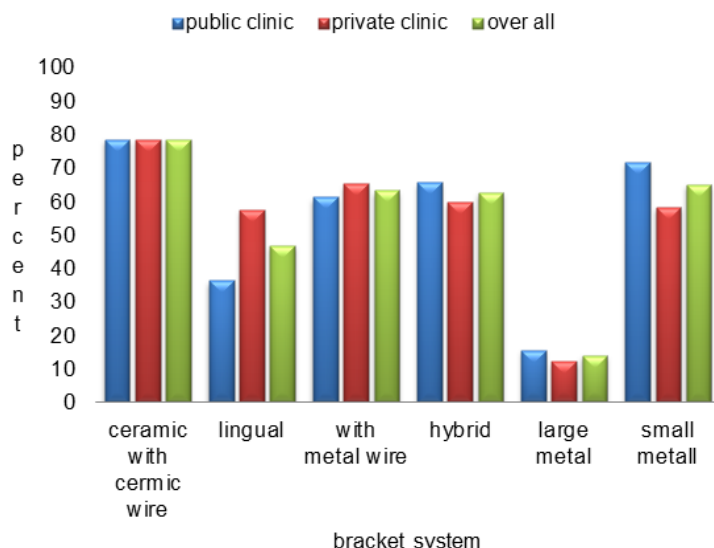
The results showed that intra-examiner reliability was 0.86 for VAS, 0.60 for acceptability and 0.93 for value. A summery for the VAS scores is given in Table 2 and the results of post-hoc analysis are shown in Table 3.

**Table 2: Mean and standard deviation of VAS scores for different brackets in each group**

Type of bracket	Public clinic patients	Private clinic patients	Art students	P value
Ceramic with ceramic wire	7.65±2.06	7.89±2.21	8.23± 1.36	0.079
Ceramic with metal wire	5.39± 2.50	5.65± 2.39	5.76± 2.45	0.240
lingual	8.55±1.84	7.98± 2.85	8.44±1.23	0.05
hybrid	5.61±1.23	5.71±1.76	6.68±2.34	0.000
Large metal	2.62± 1.65	2.76±1.36	1.98±2.01	0.262
Small metal	4.45±2.12	4.36±1.43	4.92±1.36	0.246

**Table 3: Post hoc analysis (Tukey LSD) for VAS scores**

Type of bracket	Groups	P value
Lingual	private clinic patients Public clinic patients	0.035
	private clinic patients art students	0.272
	Public clinic patients art students	0.010
Hybrid	private clinic patients Public clinic patients	0.739
	private clinic patients art students	0.000
	Public clinic patients art students	0.010



**Figure 2:** Acceptability rate of different brackets for children in the study groups

Lingual brackets were the most attractive ones followed by ceramic brackets with white coated wire. The large metal brackets were the least attractive ones in all three groups.

VAS scores for ceramic and metal brackets were similar in all groups of subjects. Differences were found in VAS scores for lingual and hybrid appliances between groups. VAS scores were compared between groups by ANOVA. Art students gave higher scores to these types of brackets when compared to orthodontic patients ( $p < 0.05$ ). VAS scores recorded for all types of appliances were smaller in females than males but the difference was only significant for hybrid brackets ( $p < 0.05$ ). Table 4 shows VAS scores in males and females.

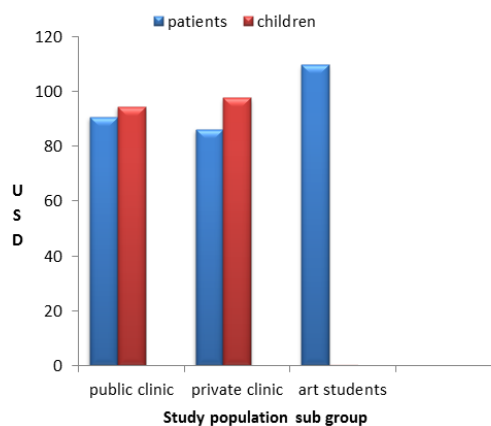
**Table 4:** VAS scores in males and females by regression analysis

Type of bracket	VAS score in males	VAS score in females	P value
Ceramic with ceramic wire	8.18±2.16	7.73±1.19	0.103
Ceramic with metal wire	6±2.28	5.32±2.27	0.064
lingual	8.43±1.52	8.20±1.34	0.417
hybrid	6.62±1.83	5.66±2.48	0.010
Large metal	2.56±1.24	2.67±2.13	0.474
Small metal	4.72±2.7	4.61±1.45	0.696

Ceramic brackets with ceramic wire have the highest rate of acceptability (76.7%) and large metal brackets have the lowest rate of acceptability (21%) in our study. The acceptability rate of different brackets was almost identical in three study populations. As seen in Figure 2, only small variations were shown between groups which were not significant. Also, the acceptability rates of different bracket types chosen for children were similar to those of adult patients in public and private clinics. Figure 2 shows the acceptability rates for children.

bility rates for children.

Regarding WTP, patients of public clinic said that they would pay \$90.7 more for ceramic brackets in comparison with large metal brackets for themselves and \$109 for their children. Patients of private clinic said that they would pay \$86.2 more for themselves and \$97.7 for their children to have aesthetic brackets instead of regular ones. The largest amount of WTP was recorded for Art students which paid \$109.6 more for ceramic brackets than metallic ones. Figure 3 summarize the WTP findings in three groups.



**Figure 3:** WTP for ceramic bracket with metal wire

### Discussion

The most important reason that any individual, especially adults, seeks orthodontic treatment is to improve their dento-facial appearance [21]. However, during the treatment period, which lasts approximately two years or more, patients must withstand the metallic view of orthodontic appliances [23]. Different types of esthetic appliances, such as ceramic brackets, lingual and hybrid systems, have developed to improve the appearance of appliances used during treatment

[3,7,8]. However, only a few studies have been published in the literature evaluating the esthetics of orthodontic appliances as perceived by patients using them. This survey was designed to evaluate the attractiveness, acceptability and value of various orthodontic appliances patients and art students.

The appliance attractiveness was measured by VAS scale in this study. Lingual braces have the highest rating followed by ceramic bracket with ceramic wire. Ceramic bracket with metal wire and hybrid brackets were ranked lower. The low ranking of these bracket systems might be due to the fact that some degree of metallic appearance exists in this appliance that makes them less attractive. The lowest rated appliances in all groups were metal brackets. However, small metal brackets were evaluated more esthetic than larger ones. These results suggest that reducing metallic parts in any appliance can increase its perceived attractiveness. This finding was similar to those of Ziuchkovski and Rosvall's studies [14,17]. In these studies, categories of appliance attractiveness were as follows: lingual and clear tray appliances, ceramic appliances, and stainless brackets. As in our study, the overall trend in appliance attractiveness seems to relate to the amount of metal visible in the appliance.

Another point of interest is the differences in appliance attractiveness ratings between groups. In our study, VAS attractiveness rating for appliance type was almost similar in the three groups of study population. This indicates that people with different socioeconomic status in our society share similar views about esthetic brackets which might be the result of advertisements made in mass media.

Appliance acceptability is more important than attractiveness clinically. Normally, more factors should be considered when rating the acceptability of any appliance. In addition to attractiveness, factors such as cost, efficiency and accessibility issues are usually considered by patients. Appliance cost is a determining factor by itself. Most brands of esthetic brackets cost much higher than their regular metallic counterparts; therefore, not every patient willing to use them is able to afford them. Also, treatment mechanics with esthetic braces often work slower than regular ones [24,25] and this can limit their use to less complex orthodontic problems. At last, access to some types of esthetic appliances, such as custom made lingual brackets [26] or Invisalign [27] systems, is limited to Western populations. In our study, we explained these factors to the participants in order to help them make an informed decision about rating the appliances.

Considering all factors, ceramic brackets with ceramic wire had the highest acceptability (76%) in our study. Acceptability rate for small metal bracket, hybrid plastic-metal brackets and ceramic brackets with metal wire was similar. Large metal brackets had the lowest acceptability rating. It appears that attractiveness is an important and determining factor of acceptability for the participants. As the esthetic parameters of appliance decreased, the rate of appliance acceptability

decreased accordingly in our study. The only exception was the lingual brackets which had the second lowest acceptability rate (46.8%) in our study, only superior to large metal brackets. It seems that low acceptability of the lingual system despite its high attractiveness is its high cost, discomfort in speech, and soft tissue injury. Another cause might be the unfamiliarity of our patients with this appliance. In contrast to our findings, the acceptability rate was over 90% for lingual braces and 55% for metal bracket in Rosvall's study [14]. Differences in findings between the current study and that of Rosvall [14] may be due to the fact that lingual braces for orthodontic treatment are common in Western countries and patients are more familiar with this type of appliances. Also, in Rosvall's study bracket, disadvantages and limitations were not discussed with patients.

Large metal brackets had the lowest acceptability rate (19.8%) in our study. This was different from the findings of some recent studies [14,20]. Although other researchers noted that varying the size of metal bracket has no effect on its attractiveness and acceptability [14,20], the finding of our research showed that small metal brackets are more acceptable than larger metallic ones and even as acceptable as hybrid brackets and ceramic brackets with metallic wire. Considering disadvantages and limitations of any appliance can have a significant influence on its acceptability by patients. It can be assumed that although metallic brackets are less attractive, other characteristics like lower cost, higher efficiency and better accessibility make it as acceptable as its more esthetic rivals in patients' view.

We used the WTP method to evaluate the value of various orthodontic appliances by means of a cost-benefit analysis. We assessed WTP using the payment scale method rather than an open-ended format similar to Rosvall's study method [14]. No difference was found between these two methods in previous studies [22]. WTP value showed that adults are willing to pay more for their children than themselves for ceramic brackets with metal wire. Art students were willing to pay more than two other groups which mean this group of subjects put greater value for beauty.

The amount of WTP was recorded in art students which were willing to pay \$109.6 more for ceramic bracket with metal wire. This amount may appear low but it reflects the real behavior of this study population. Generally, the results of WTP studies in developing countries are more realistic because in these countries the cost of treatment is usually paid directly by individuals but in developed countries the costs are mainly paid by insurance companies.

## Conclusions

1. Orthodontic appliances attractiveness rates are as follows: lingual brackets>ceramic bracket with ceramic wire>ceramic bracket with metal wire>hybrid bracket>small metal bracket>large metal bracket.

2. Despite the highest attractiveness of lingual braces, this type of bracket has low acceptability.

3. Large metal brackets have the lowest attractiveness and acceptability among other bracket systems, which was statistically significant.

4. Adults tended to treat their children with esthetic appliances, even if they had to pay more.

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