

Youth Perception of Different Orthodontic Appliances

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Reem A Alansari 

Department of Orthodontics, Faculty of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia

Purpose: To explore youth perception of the esthetics of different orthodontic appliances measured using different concepts of esthetics.

Patients and Methods: A questionnaire was answered by 194 youth participants (35.5% were 9–11 years old; 32.5% were 12–14 years old; and 32% were 15–17 years old). Participants evaluated and compared the attractiveness of images of different orthodontic appliances using a Likert scale. They indicated the acceptability of the appliances with a yes/no answer. They then chose which appliance to rank as their most preferred.

Results: The highest median attractiveness rating was for clear aligners (Mdn= 8, IQR= 4.25), followed by lingual and standard ceramic brackets (Mdn= 7, IQR= 6). The lowest median attractiveness rating was for hybrid brackets (Mdn= 4, IQR= 4). Clear aligners were significantly more attractive than all other orthodontic appliances ($P<0.0001$). Clear aligners also had the highest percentage of acceptability (80%), while hybrid brackets scored the lowest (42%). Ceramic and metal brackets fell in the middle range of attractiveness and acceptability but were chosen by male middle schoolers as their preferred appliances. Clear aligners were ranked the highest by this cohort.

Conclusion: This study demonstrates the widespread preference and acceptability of clear aligners among the youth. Other orthodontic appliances were acceptable but to a lesser extent than clear aligners. This study informs orthodontists about their youth consumers' behavior and may help inform treatment discussions in the orthodontic clinic.

Keywords: children, adolescents, preference, attractiveness, braces

Introduction

The demand for esthetic orthodontic appliances has influenced their evolution over the decades.^{1,2} In the early 1970s, bondable brackets replaced the long-used metal bands that used to wrap each tooth covering most of its surface. Elastomerics improved the esthetic value of orthodontic appliances and provided patients a way to express themselves in colors. However, self-ligating brackets that use gates, instead of elastomerics, to hold the archwire remain very popular with orthodontists who want to minimize office visits and for patients who do not prefer wearing elastomerics. Then came tooth-colored ceramic or plastic brackets, as well as clear aligner trays to provide an even more inconspicuous alternative to metal brackets. Furthermore, lingual brackets came out to provide a truly invisible orthodontic treatment experience. Shaped brackets were also introduced to the market to try to appeal to children and teenager esthetic needs.^{1,3}

It has been shown that public perception, as well as self-perception of attractiveness, confidence, education, intelligence, social skills, popularity, employment,

Correspondence: Reem A Alansari
Department of Orthodontics, Faculty of Dentistry, King Abdulaziz University, Jeddah 21589, Saudi Arabia
Email ralansari@kau.edu.sa

and success may be affected by the appearance of orthodontic appliances.⁴⁻⁷ However, lay people's perception of orthodontic appliances revealed differences that may vary with age and social or cultural values.⁸⁻¹³

Adults from the USA and Brazil were found to give high esthetic value to inconspicuous appliances such as clear aligners, lingual brackets, and tooth-colored brackets.^{8,9} A study found Iranian adults to also prefer clear aligners but to extremely disapprove of lingual brackets.¹¹ Adults in Saudi Arabia also echoed American and Brazilian adults in their high preference for inconspicuous orthodontic appliances like clear aligners and lingual brackets.¹³

To investigate the esthetic value of orthodontic appliances for youth consumers, some studies asked adults about their preference for their kids.^{9,12,13} Only two studies from the United States and Brazil directly addressed youth orthodontic appliance preferences.^{14,15} Youth appliance perceptions and preferences were not studied in Arab countries. Knowledge of these perceptions may play a role in driving research and development of orthodontic products that suit this population and help align these perceptions with the requirements of orthodontic treatment. This study's aim was to explore youth's perception of attractiveness, acceptability, and their preferences with regards to the different orthodontic appliances in use in Saudi Arabia.

Patients and Methods

King Abdulaziz University Faculty of Dentistry Institutional Review Board approved this study which abides by the principles outlined in the Declaration of Helsinki. Data were collected by administering a questionnaire to a sample of youth (aging 9–17) inquiring about the level of attractiveness, acceptability, and preference they assign to a variety of commonly available orthodontic appliances. Participants were conveniently recruited from shopping malls and dental clinics in the city of Jeddah, Saudi Arabia. Those who had been orthodontically treated were excluded as their perceptions may be affected by their treatment experience. The sample size was calculated using G*power, version 3.1.9.2. The minimal sample size necessary to detect a moderate or large difference in the proportions of youth acceptability of orthodontic appliances (corresponding to a Cohen's effect size of 0.3), with a power of 0.8 and an alpha of 0.05, was 143 participants. A total of 379 youth were asked to take part in the study and 194 were included. The main reason for not being included was not being able to get the

guardians' consent. Parents or legal guardians provided informed consent for all study participants.

The preparation of the questionnaire was thoroughly explained in a previously published study.¹³ Participants were shown standardized photographs of a model (Figure 1) wearing nine different orthodontic appliances. The model consented to the use and publication of her smiling frontal oral photographs. The nine orthodontic appliances represented in the study were: metal brackets with transparent and colored O-ties, ceramic brackets with transparent O-ties, self-ligating metal and ceramic brackets, hybrid (metal and ceramic) brackets, shaped brackets (heart and superman logo), Clear trays, and bare teeth to simulate lingual brackets. All the preparation that went into the appliances and photography was thoroughly explained in a previously published study.¹³

A portable tablet was used by participants to view the photos and fill out the questionnaire. The questionnaire started with demographic questions. The set of questions that followed were directed at measuring the level of attractiveness of each of the nine orthodontic appliances on an 11-point Likert scale starting from 0 "extremely unattractive" to 10 "extremely attractive". The next set of questions were directed at indicating the acceptability of each appliance, with a yes/no answer. Lastly, participants were asked to rank the most preferred appliance. For Attractiveness and acceptability, participants viewed appliances consecutively, while for preference they viewed all appliances at once. Participants were free to take their time and to go back and forth while filling the questionnaire.

Table 1 shows the demographic characteristics of the study participants. The sample was nearly equally distributed according to gender and school level/age (primary school 9–11 years old, middle school 12–14 years old, and high school 15–17 years old). The average age of participants in the whole sample was 13.1 years of age (SD=2.9), while for the primary, middle, and high school groups were 10 (SD=0.94), 12.9 (SD=0.83), and 16.2 (SD=0.74), respectively.

Statistics were performed by Statistical Package for Social Sciences for Windows, version 25 (IBM Corp., Armonk, NY, USA). To test Intrarater reliability, 20 random participants were asked to redo the questionnaire again after 2 weeks. Intrarater reliability was analyzed with the Intraclass correlation coefficient (ICC). Demographic characteristics were calculated by frequency distributions. To determine the statistical significance of the difference in attractiveness scores of different appliances Friedman's

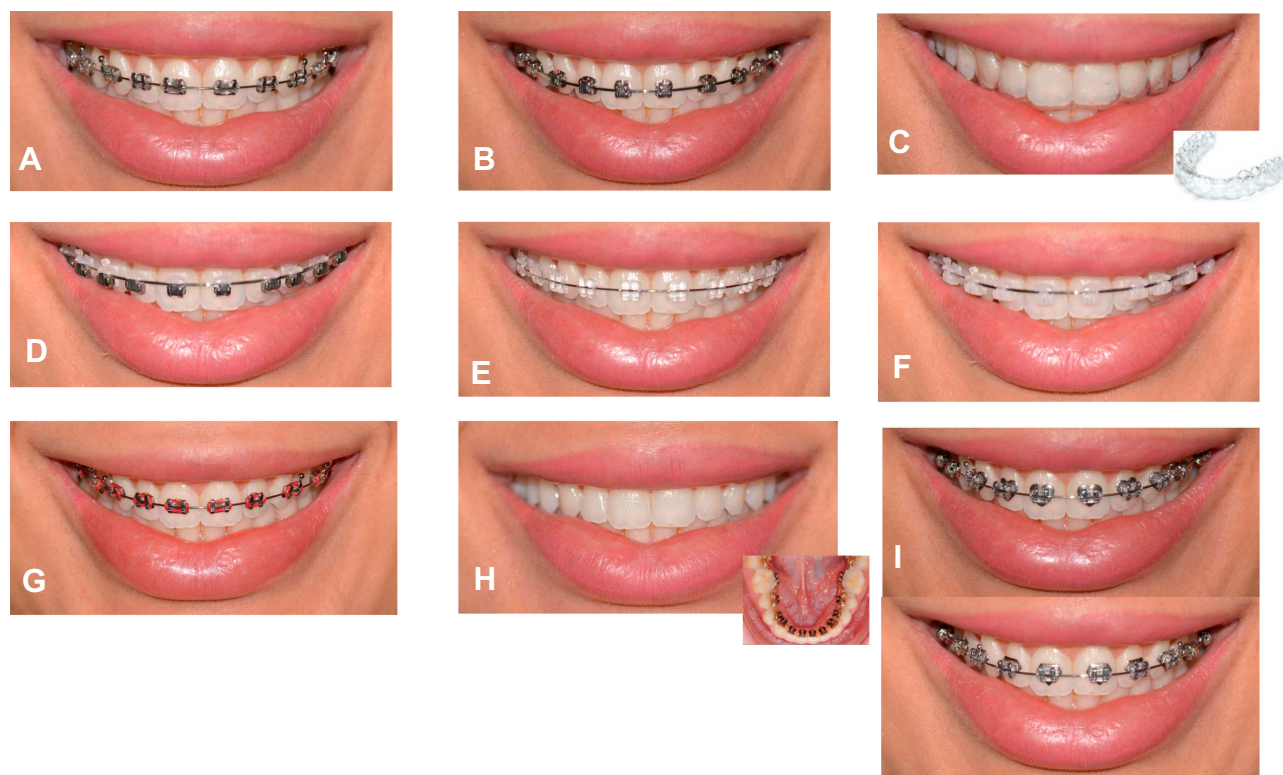


Figure 1 Orthodontic appliances evaluated by participants: (A) Metal brackets with transparent O-ties; (B) self-ligating metal brackets; (C) clear aligner; (D) hybrid brackets; (E) ceramic brackets with transparent O-ties; (F) self-ligating ceramic brackets; (G) metal brackets with colored O-ties; (H) bare teeth to simulate lingual brackets; and (I) shaped brackets (heart and superman logo).

non-parametric test was used. Pairwise comparisons using the Wilcoxon Signed-Rank test with Bonferroni corrections (significance at P value = $0.05/36 = 0.001$) were used for multiple comparisons. A binomial test was used to assess if the proportion of youth acceptability to each appliance is significantly different from 0.5 with the assumption that half of the participants would accept an appliance. To inspect any association between appliance acceptability and demographic variables Chi-square test was utilized. To examine participants' most preferred appliance frequency distributions were used.

Table 1 Demographic Characteristics of the Participants (N=194)

Demographic Variables	N	Prevalence
Gender		
Male	89	45.9%
Female	105	54.1%
School level		
Primary school (9–11)	69	35.5%
Middle school (12–14)	63	32.5%
High school (15–17)	62	32%

Results

The intra-rater reliability of participant ratings of orthodontic appliance attractiveness was strong (mean ICC was 0.83 (95% confidence interval=0.79–0.86)) and 0.73 for acceptability ratings (95% confidence interval=0.67–0.78).

Figure 2 shows the median and interquartile range of the ratings of the attractiveness of different orthodontic appliances by participants of all ages. The highest median attractiveness rating was for clear aligners (Mdn= 8, IQR= 4.25), followed by lingual and standard ceramic brackets (Mdn= 7, IQR= 6). The lowest median attractiveness rating was for hybrid brackets (Mdn= 4, IQR= 4). Pairwise comparisons using the Wilcoxon Signed Rank test with a Bonferroni correction setting the P -value threshold at 0.001 in the entire sample revealed (Figure 2) that clear aligners were significantly found to be more attractive than all other orthodontic appliances. Hybrid brackets were found to be significantly less attractive than all other orthodontic appliances. There were otherwise no statistically significant differences between the attractive ratings of other orthodontic appliances.

Figure 3A–C shows the median and interquartile range of attractiveness ratings in each of the age groups. Clear aligners had the highest median attractiveness score in all

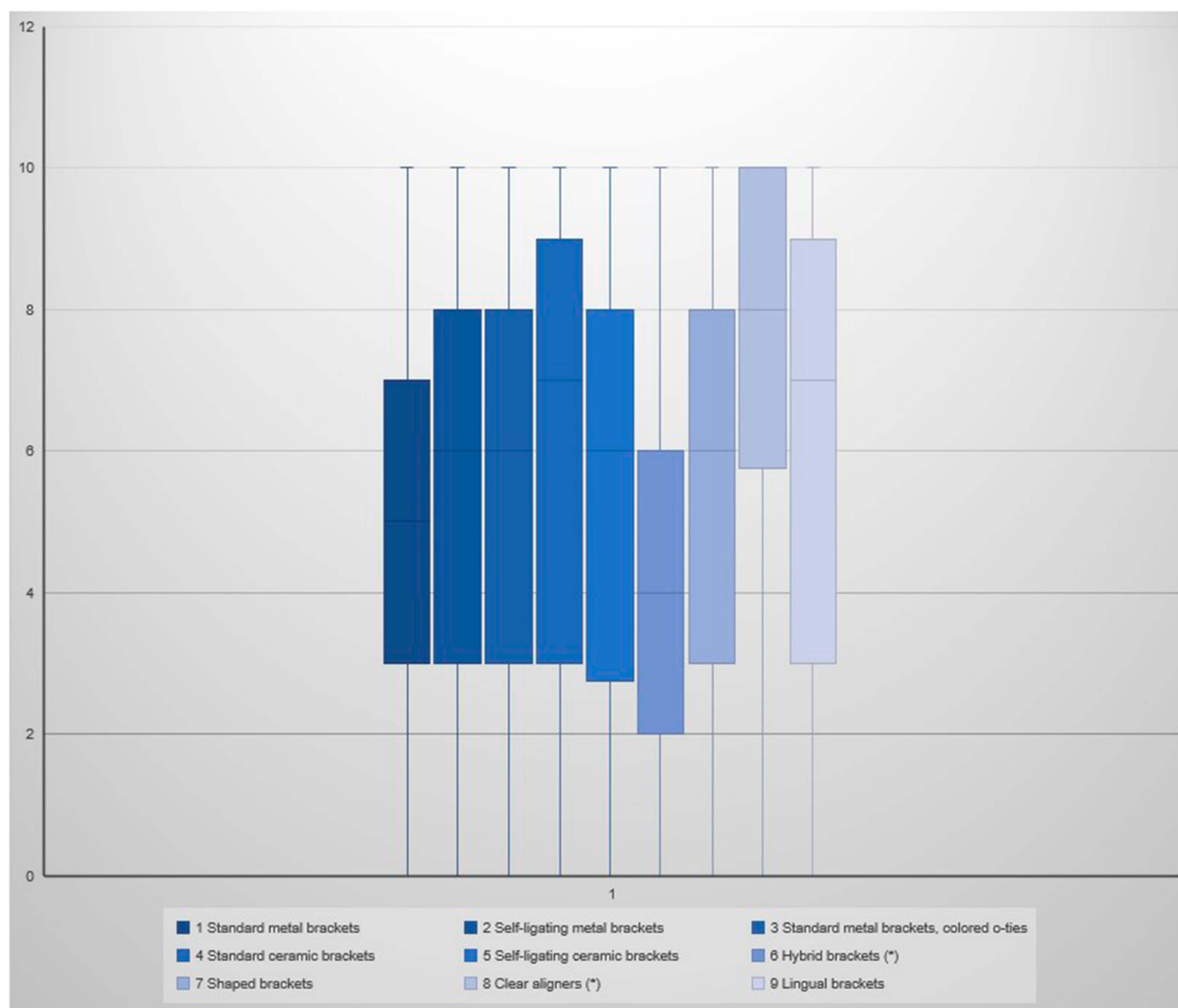


Figure 2 Attractiveness ratings of different orthodontic appliances displayed with a box and whisker plot showing the median and interquartile range for all ages. *Indicates a statistically significant relationship ($P < 0.001$) with all other appliances.

age groups, (Mdn= 8, IQR= 3.5 for primary school), (Mdn= 8, IQR= 5 for middle school), and (Mdn= 8.5, IQR= 4 for high school). The hybrid brackets had the lowest median attractiveness rating in all groups Mdn= 4, IQR= 4 for primary school, (Mdn= 4, IQR= 5 for middle school), and (Mdn= 4.5, IQR= 4.5 for high school). A statistically significant difference ($P < 0.001$) was found in the attractiveness scores of various orthodontic appliances using Friedman test.

When the pairwise comparisons were made between attractiveness ratings by participants from the primary school age group (Figure 3A), clear aligners had significantly higher attractiveness scores than all other orthodontic appliances except for the shaped brackets, where the relationship was not significant. Standard ceramic brackets

were significantly more attractive than standard metal ones. The hybrid brackets were found to be significantly less attractive than the shaped and both types of metal and ceramic brackets. There were otherwise no differences between attractive ratings assigned by the primary school age group to different orthodontic appliances. Among secondary school participants (Figure 3B), clear aligners were given significantly higher attractiveness ratings only when compared to self-ligating metal and ceramic and hybrid brackets. Hybrid brackets had significantly lower attractiveness ratings than lingual brackets. There were otherwise no statistically significant differences between attractiveness ratings of different appliances within this age group. Among the high school participants (Figure 3C), clear aligners had a significantly higher attractiveness rating

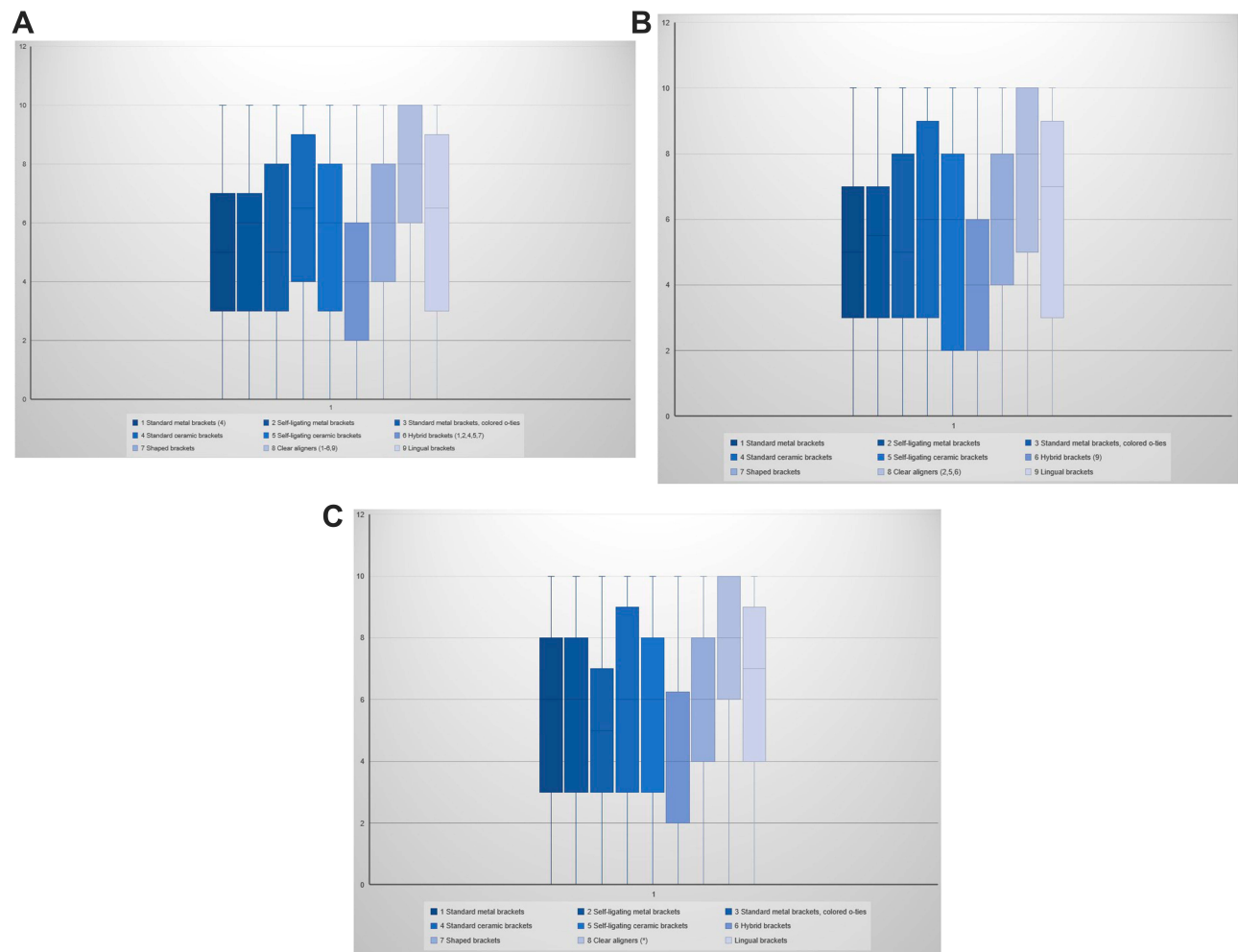


Figure 3 Attractiveness ratings of different orthodontic appliances displayed with a Box and whisker plot showing the median and interquartile range: (A) primary school; (B) middle school; and (C) high school. *Bracketed numbers indicate a statistically significant relationship ($P<0.001$) with indicated appliances.

than all the other orthodontic appliances. There were no other statistically significant differences between the other orthodontic appliances in terms of their attractiveness ratings among this age group. The comparisons were also made within the groups of males and females, but no significant differences were found.

Figure 4 demonstrates the percentage of participants finding each of the orthodontic appliances acceptable in the entire sample. Clear aligners had the highest percentage of acceptability (80%), while hybrid brackets scored the lowest (42%). Using the binomial test, youth acceptability of clear aligners, standard and self-ligating of metal brackets, and standard ceramic brackets was significantly higher than the expected 50% ($P=0.012$, $P<0.001$, $P<0.001$ and $P<0.001$ respectively). The acceptability of the other appliances was not significantly different from the expected 50%. A Chi-square comparison revealed no

differences between males and females with regards to the acceptability proportions for each orthodontic appliance ($P>0.05$). The proportion of acceptability of appliances was calculated in each of the age groups (Figure 5A–C).

With regards to the appliance most preferred across all ages, clear aligners were the most frequent to be ranked as the most preferred appliance by 34% of participants. Both males and females most frequently ranked clear aligners as their most preferred appliance (30%, 37%, respectively). The appliance preference in every age group shows clear aligners were the most preferred orthodontic appliances in the primary and high school age groups (42% and 37% respectively), whereas the middle school age group the highest-ranking was given to clear aligners in addition to lingual and standard metal brackets (23%). The preference for standard metal brackets within the middle school age group was driven by the proportion of males within this

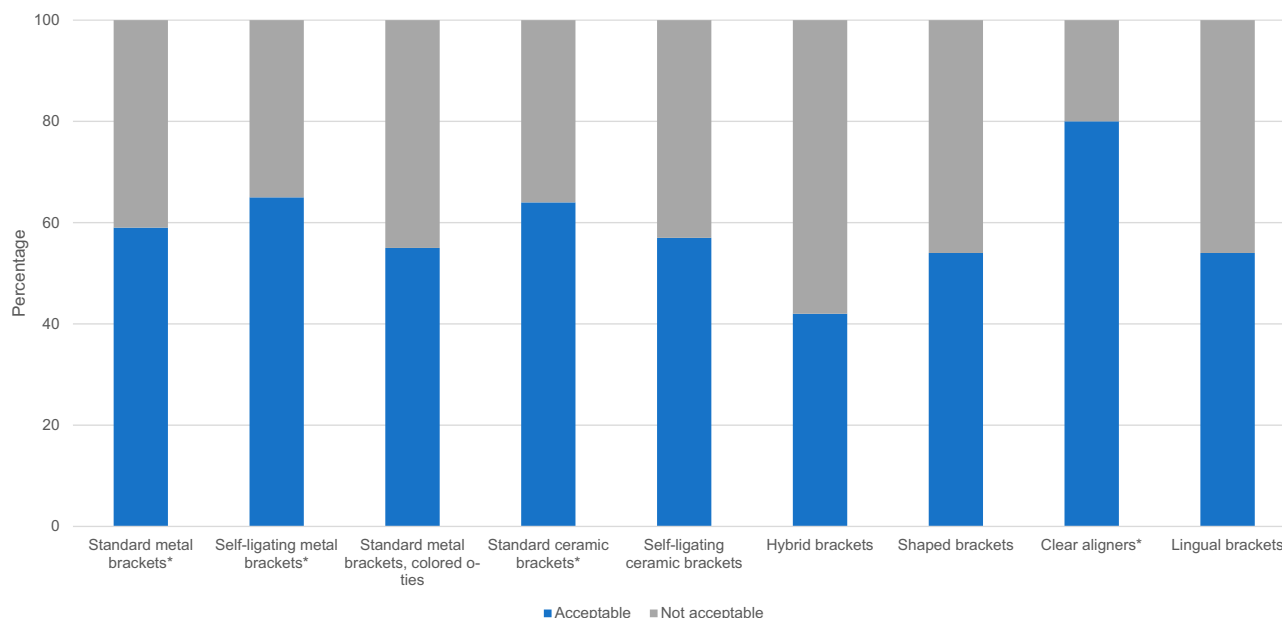


Figure 4 Acceptability of orthodontic appliances for all ages. *Indicates a statistically significant relationship ($P < 0.001$) with all other appliances.

age group that chose standard metal brackets (30%), while females within this age group drove the choice of lingual brackets (29%).

Discussion

This study demonstrates the widespread perception of attractiveness, acceptability, and preference of clear aligners among the majority of our sample of youth participants across the age groups. The majority of participants found clear aligners to be the most attractive and ranked them as their first choice. This is somewhat different from two prior studies done in Brazilian and American youth.^{14,15} Among participants in these two samples only the older youth from the American sample found clear aligners to be the most attractive and rather preferred lingual brackets, metal brackets, and colored elastomerics. These appliances were generally acceptable in our sample but less so than cleared aligners. Lingual brackets were both only found to be attractive and acceptable by the oldest subset of our sample (high school students). Primary school students found these brackets to be both unattractive and unacceptable. Middle school students found them attractive but thought they were not acceptable, raising the possibility that they were dismayed by the discomfort these brackets may cause. Our cohort ranked clear aligners as their most preferred appliance, with the exception of middle schoolers who equated clear aligners, lingual brackets, and standard metal brackets as their preferred appliances. Metal brackets with colored

o-ties and shaped brackets, preferred by the Brazilian and American samples, were not seen as highly attractive or acceptable among our sample, which may be a cultural difference between these populations. Hybrid brackets were uniformly found to be unattractive and unacceptable among our participants. This is another unique finding in our cohort and requires further study. In addition to their potential inherent esthetic appeal, aggressive marketing of clear aligners by their manufacturers may contribute to their popularity. Over the past decade, clear aligner companies have used direct-to-consumer marketing strategies in many countries, including Saudi Arabia where companies can reach youth consumers directly on social media platforms and have aggressively engaged orthodontists and even general dentists in these campaigns. This may have contributed to the popularity of clear aligners among youth in our sample as opposed to the previously published studies.^{16–18}

The appearance of orthodontic appliances has been shown to impact the judgment of others' personal attributes as well as the judgment of one's own body image.⁷ It has become a necessity for orthodontists to understand the consumers and provide them with options that do not affect their orthodontic experience negatively. This applies to the youth population as well. Adult perceptions and decisions with regards to children's orthodontic appliance choices do not necessarily match the children's. Some studies asked adults about their preferred choice of an orthodontic appliance for their kids.^{9,12,13} While Rosvall et al and Alansari

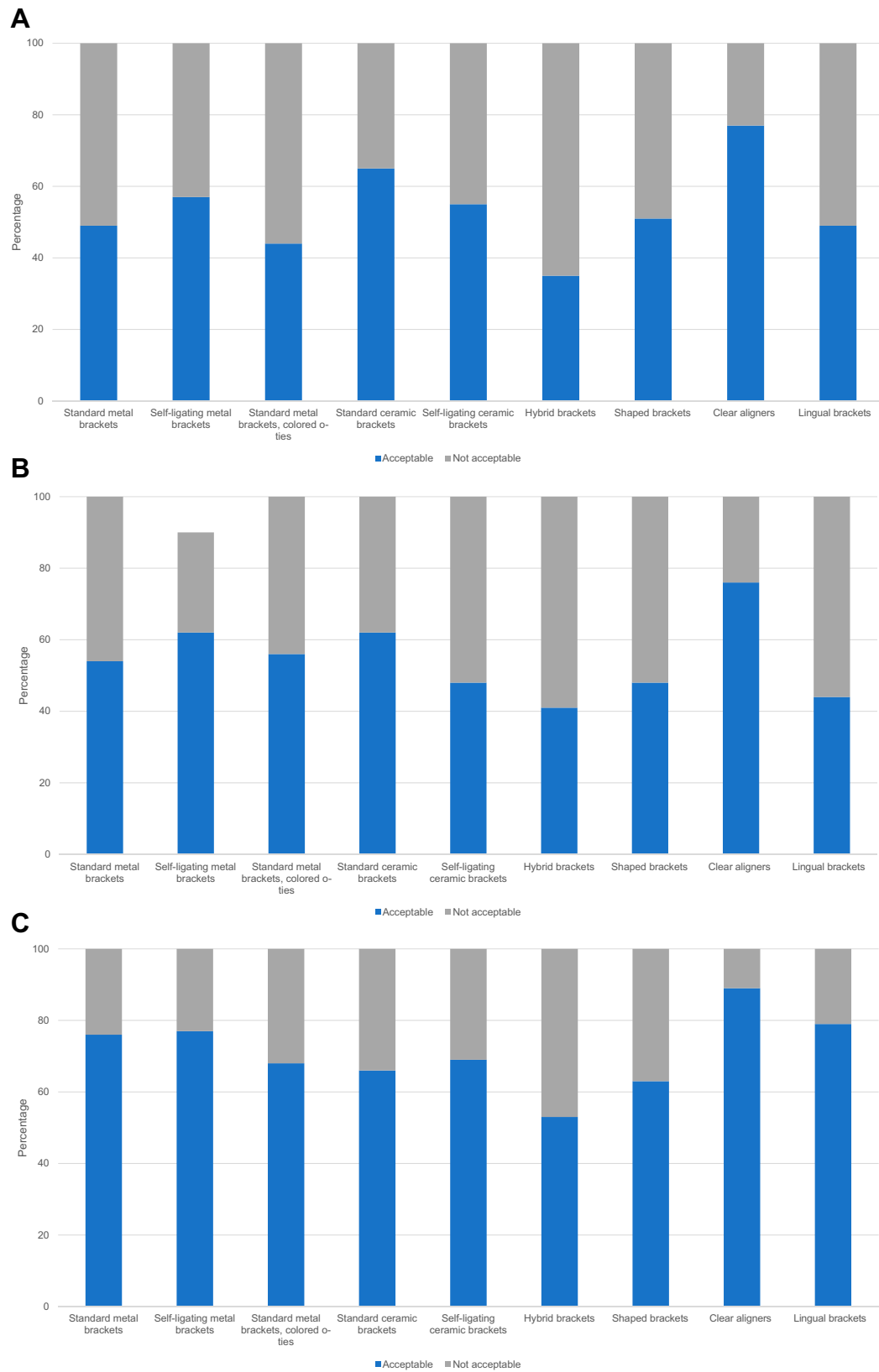


Figure 5 Acceptability of orthodontic appliances: **(A)** primary school; **(B)** middle school; and **(C)** high school.

et al found that American and Saudi adults, respectively, have similar orthodontic appliance acceptability for themselves and their kids, Ziuchkovski et al found that adults in the USA accepted orthodontic appliances, such as metal appliances, for their kids that they did not accept for themselves.^{13–15} This study provides direct knowledge of what the Saudi youth of different age groups prefer, find attractive and acceptable, and is a first step toward understanding their consumer behavior in the orthodontic clinic.

This study is one of three studies that gather data about the perception of orthodontic appliance esthetics directly from a sample of the youth and the only study that has done so in Saudi Arabia. Perception of efficiency, discomfort, or monetary value of orthodontic appliances was not addressed in this study. These variables were previously studied and may certainly affect patients' preferences, but it was outside the scope of this paper where participants were clearly asked to make their choices based on the esthetic value they ascribe to the different orthodontic appliances.^{19–24} A limitation of this study may stem from the well-aligned teeth of the model displaying the appliances which is not representative of the reality that the appliances are placed on misaligned teeth, hence, they may look different. Another limitation is the illustration of clear aligners without the use of attachments which may not be representative of all clear aligner case scenarios. Another limitation may arise from taking 10 different photographs of the same individual wearing 10 different appliances, as opposed to taking one photograph of a model and digitally manipulating it to display 10 different appliances. This methodology may introduce slight differences in variables related to the model's smile, for example tooth, gingival or lip exposure.

In conclusion, this is the first study in Saudi Arabia to report the youth's perception of attractiveness, acceptability, and preferences with regards to the orthodontic appliances. The main finding of this study shows that clear aligners were uniformly seen as attractive, acceptable, and preferred among this population. Other orthodontic appliances were acceptable but less than clear aligners. These are important cultural differences from studies done in other cultures and this should inform treatment discussions in the orthodontic clinic.

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Disclosure

The author reports no conflicts of interest in this work.

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