

Changing Paradigm in Orthodontics - Invisible Braces: Perception of Indian Adult Population of Clear Aligners vs. Lingual Appliance vs. Ceramic Appliance, Questionnaire Survey

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Abstract

Introduction: The purpose of this study was to evaluate the perception of adult population reporting to the department of orthodontics about various aesthetic appliances - Clear aligners vs Lingual appliance vs Ceramic appliance compared to labial metal braces. **Methods:** Cross-sectional survey with validated questionnaire. The study was in two phases, the first phase consisted of developing a valid questionnaire based on previous studies and expert opinion. Reliability testing of the questionnaire was then carried out by conducting a pilot study by personally surveying 100 adult patients who reported on the Out-patient basis to the Dental institution. An introductory cover letter and information sheet that contained a brief description of all the appliances to ensure full understanding of the questions was included with close ended questions on demographics, smile satisfaction, willingness to undergo orthodontic treatment, knowledge of Aesthetic appliances, and the fees they would be willing to pay for different appliances. **Results:** All the 100 participants completed the survey. About 82% of the adult participants showed some degree of concern regarding their smile and dental appearance, and approximately 85% of them were willing to undergo some form of fixed appliance therapy to improve the appearance of their smile. Almost 40% of the adults chose Clear Aligners as the first preference, and approximately 60% of the adults regarded Stainless steel braces as the least desirable. The preference of the appliance was also affected by the level of education. **Conclusion:** with increase in the number of adults seeking orthodontic care, there is an increased demand for various aesthetic appliances. Most people reported a sense of hesitation to wear the 'Train-track' metal braces because of their unsightly appearance. When given the option, 80% of the adults deem aesthetic appliance (Clear aligners, Lingual Appliance, Ceramic Appliance) as attractive and acceptable, whereas only 20% viewed stainless steel brackets in a similar light.

Keywords: Adult Orthodontics, Patient Perception, Aesthetic Appliances, Train-Track Braces, Clear Aligners.

1. INTRODUCTION

Research has shown how physical appearance and attractiveness of a person has an effect on his quality of life and this is a point of increasing concern for today's youth as well as elder population alike. Last decade has witnessed a drastic increase in the number of adults seeking orthodontic care owing to increased awareness of

the need for better quality of life, high life expectancy, and improved availability of resources.

According to Krishnan. V *et al*¹, an orthodontists practice is composed of more than 50% of adults (Figure 1). In a recent survey conducted amongst the general population of United Kingdoms, by the government, showed that approximately 45%

of the adults are unhappy with the appearance of their teeth. About 20% would be willing to having some form of orthodontic intervention to enhance the alignment and the aesthetics of their teeth.

But with this age transition, there comes an increased need for aesthetics and other age related complications. Most people reported a sense of hesitation to wear the 'Train-track' braces because of the an-aesthetic appearance of the metal braces. In a survey in 2009 by British Lingual Orthodontic Society, it was found that '72%' of the people were not aware of the options of 'Invisible braces'. When given the option, 90% of the adults deem aesthetic appliance (Clear aligners, Lingual Appliance, Ceramic Appliance) as attractive and acceptable, whereas only 55% viewed stainless steel brackets in a similar light.

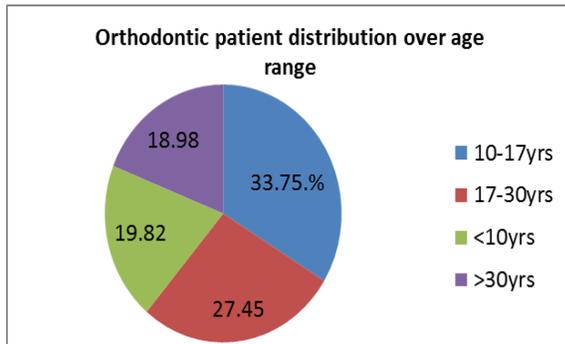


Fig. 1 Orthodontic patient distribution over age range

Today, with the invent of Clear Aligners, Ceramic Braces, Lingual Braces, various forms of invisible braces, we have the potential to engage and interest increasing numbers of adults for orthodontic treatment, who earlier were averse to the idea of wearing a metallic smile to the work place or a social gathering³.

Most commonly used and most effective appliance to date is fixed labial appliance made up of stainless steel metal. In spite of being the most effective appliance with excellent properties- low friction, good resilience to breakage and superior debonding qualities, the appearance of the brackets are anaesthetic⁴. And hence have been largely disregarded by the adult population.

The aesthetic appliance⁵ evolved with the introduction of aesthetic ceramic brackets in 1986

and has motivated many adults to seek orthodontic treatment, as the aesthetic brackets are less visible and more socially acceptable. The majority of currently available aesthetic brackets are ceramic, composed from an aluminium oxide material. Attempts with plastic brackets showed highly unstable and poor results. Full ceramic brackets came with the advantages of acceptable aesthetics, rigidity, strength, structural stability, but they are brittle and prone to recurrent fracture.

Lingual Appliance treatment has been quoted in orthodontic literature as far back as 1726, with Fauchard using appliance on the lingual surface to move teeth⁶. With its worldwide introduction in 1970s and the mass euphoria around the appliance made it an instant favourite with the celebrities and the elites. Though the poorer quality of finishing in completed cases led to a decline its popularity. With a new improved design, enhanced understanding of the biomechanics, this appliance has made a comeback.

Clear aligners were first introduced in 1999 and have caught the fancy of the new age dentists as well as patients alike⁷. It involves wearing a series of customized clear plastic aligners for a period of 20 hours per day. They are changed after every two weeks. They are fabricated using CAD/CAM technology is combined with virtual 3D model. A usual course of treatment requires an average of 20-25 aligners depending on the difficulty of the malocclusion.

With better aesthetics comes the need for increased manufacturing cost. In countries like India, where dental care is not included under insurance cover, the expense of the material has to be solely borne by the patient. Therefore cost also influences the patient's preference of an appliance². We have witnessed similar trends in Indian orthodontic population with increased number of adults now walking into an orthodontist's clinic for treatment⁸. But the literature is particularly lacking in the evidence about Indian adult population perception regarding these aesthetic appliance availability. The goal of this survey was to determine the perception of Indian adult population on various invisible braces available today and how willing they will be to undergo fixed orthodontic treatment with these aesthetic appliances.

2. MATERIAL AND METHODS

The study was conducted in two phases. The first phase consisted of developing a questionnaire based on previous studies⁹. The questionnaire was validated with the help of expert opinion from the faculty of the department of orthodontics¹⁰. The study was conducted by personally surveying 100 adult patients who reported on the Out-patient basis to the Dental institution. An introductory cover letter, an information sheet (Appendix A) that contained a brief description of all the appliances to ensure full understanding of the questions was included. Questionnaire (Appendix B) consisted of close ended questions on demographics, smile satisfaction, willingness to undergo orthodontic treatment, knowledge of Aesthetic appliances, and the fees they would be willing to pay for different appliances. The study was conducted in the university setup under the Department of Orthodontics & Dentofacial Orthopaedics, Ramaiah University of Applied Sciences, involving the adults reporting to the Dental College for dental treatment.

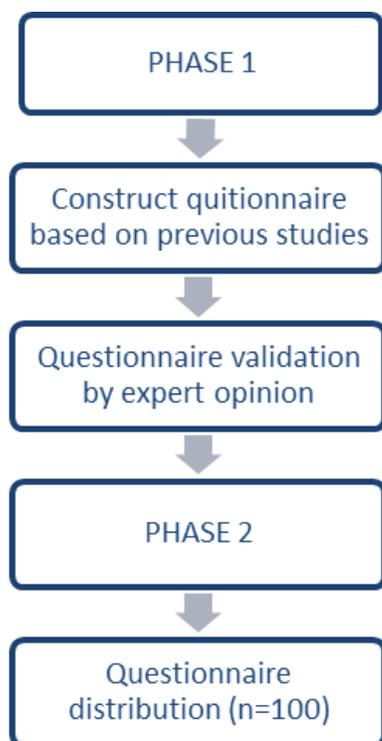


Fig. 2 Summary of method

Adults, above 20 years of age who could read and understand English well and consented to participate in the survey were included. Patients currently under active orthodontic treatment or with a past history of orthodontic treatment, patients with craniofacial deformities or medically handicapping conditions were excluded from the survey.

3. STATISTICAL ANALYSIS

Simple descriptive statistics were used to recapitulate the data. Frequency distributions were employed for definite variables. Means, standard deviations, and percentile distributions were studied for continuous data. Demographic features of the participants were also examined. These included sex, age, address, and highest level of education obtained in the family and household income for the adult patients who took part in the study. Responses to the questionnaire were tabulated by the primary variables of interest (including willingness to use an orthodontic appliances, willingness to pay for aesthetic appliance, and preference for different aesthetic appliances). The correlation between patient characteristics (highest level of education obtained in the family) and interest in adopting any form of orthodontic appliance was assessed by chi-square tests wherever suitable. All tests were 2-sided, with a P value of 0.05 deemed to be statistically significant. The data were concealed of unique identifiers and transferred to an SPSS data sheet. All analyses were conducted using SPSS software (version 20.0; IBM, Armonk, NY).

4. RESULTS

A total of 100 adult patients consented and completed the survey out of which 48% were female and 52% were male. The financial attributes and the highest level of education attained by them is summarized in Table 1. Most of the participants, 59%, reported that they had attained 4 years and more of education.

Most people reported some degree of concern regarding the appearance of their smile (Table2). The higher educated group reported greater degree of concern regarding their and dental appearance.

Most of the patients with higher education status showed more willingness to undergo some form of fixed orthodontic treatment (Table 3).

Were as people with lower education status showed increased reluctance to any form of fixed appliance treatment.

Table 1. Demographic division of patients based on the level of education

	Primary school or less		High school or less		More than high school but less than 4 years of college		4 years of college or more	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
<Rs200,000	2	66.7	6	60.0	6	21.4	14	23.7
Rs200,000-600,000	1	33.3	4	40.0	17	60.7	16	27.1
Rs600,000-10,00,000	0	0	0	0	4	14.3	22	37.3
>Rs10,00,000	0	0	0	0	1	3.6	7	11.9
Total	3	100.0	10	100.0	28	100.0	59	100.0

Table 2. Smile satisfaction among the participants

	Less than high school		High school or less		More than high school but less than 4 years of college		4 years of college or more	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Not concerned at all	2	66.7	1	10.0	5	17.9	10	16.9
Somewhat concerned	1	33.3	5	50.0	7	25.0	21	35.6
Concerned	0	0	1	10.0	2	7.1	8	13.6
Very Concerned	0	0	3	30.0	14	50.0	20	33.9
Total	3	100.0	10	100.0	28	100.0	59	100.0
Chi-square value- 4.69								
p value- 0.85								

Table 3. Willingness to seek any form of fixed orthodontic treatment

	Less than high school		High school or less		More than high school but less than 4 years of college		4 years of college or more	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Most willing	0	0	3	30.0	8	28.6	19	32.2
Somewhat willing	0	0	5	50.0	13	46.4	22	37.3
Somewhat unwilling	1	33.3	2	20.0	4	14.3	8	13.6
Most unwilling	2	66.7	0	0	3	10.7	10	16.9
Total	3	100.0	10	100.0	28	100.0	59	100.0
Chi-square value- 4.29								
p value-0.89								

Most of the participants seemed to be aware of these invisible braces to certain extent. Only 19% of the adults showed most willing attitude

towards the stainless steel 'train-track' braces (Table 4).

Table 4. Willingness to undergo treatment with train-track braces

	Less than high school		High school or less		More than high school but less than 4 years of college		4 years of college or more	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Most willing	2	66.7	0	0	10	35.7	7	11.9
Somewhat willing	1	33.3	5	50.0	11	39.3	28	47.5
Somewhat unwilling	0	0	5	50.0	3	10.7	16	27.1
Most unwilling	0	0	0	0	4	14.3	8	13.6
Total	3	100.0	10	100.0	28	100.0	59	100.0
Chi-square value- 11.27								
p value- 0.25								

Whereas reactions recorded towards Seamless ceramic braces were majorly positive, with 82% of people showing willingness to undergo treatment with this appliance (Table 5). Most

participants agreed to a 20 to 40% increase in charges for reduced visibility of the braces with seamless ceramic appliance.

Table 5. Willingness to undergo treatment with seamless ceramic braces

	Less than high school		High school or less		More than high school but less than 4 years of college		4 years of college or more	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Most willing	2	66.7	6	60.0	9	32.1	27	45.8
Somewhat willing	0	0	3	30.0	9	32.1	28	47.5
Somewhat unwilling	1	33.3	1	10.0	10	35.7	2	3.4
Most unwilling	0	0	0	0	0	0	2	3.4
Total	3	100.0	10	100.0	28	100.0	59	100.0
Chi-square value- 18.08								
p value- 0.03*								

People showed relatively neutral response towards lingual appliance as they deemed it to be uncomfortable as it is placed closer to the tongue.

Table 6. Willingness to undergo treatment with lingual appliance

	Less than high school		High school or less		More than high school but less than 4 years of college		4 years of college or more	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Most willing	0	0	3	30.0	7	25.0	11	18.6
Somewhat willing	3	100.0	4	40.0	7	25.0	26	44.1
Somewhat unwilling	0	0	3	30.0	10	35.7	17	28.8
Most unwilling	0	0	0	0	4	14.3	5	8.5
Total	3	100.0	10	100.0	28	100.0	59	100.0
Chi-square value- 4.24								
p value- 0.89								

Clean aligners was an option that was found to be most attractive amongst the patients. The response was favourable across all the education

groups (Table 7) and people agreed to an increase in cost by about 40-60%.

Table 7a. Willingness to undergo orthodontic treatment with clear aligners

	Less than high school		High school or less		More than high school but less than 4 years of college		4 years of college or more	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Most willing	2	66.7	3	30.0	13	46.4	26	44.1
Somewhat willing	1	33.3	6	60.0	10	35.7	20	33.9
Somewhat unwilling	0	0	1	10.0	5	17.9	9	15.3
Most unwilling	0	0	0	0	0	0	4	6.8
Total	3	100.0	10	100.0	28	100.0	59	100.0
Chi-square value- 3.47								
p value- 0.94								

Table 7b. Willingness to pay an increased fee for clear aligners

	Less than high school		High school or less		More than high school but less than 4 years of college		4 years of college or more	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
10%	0	0	1	10.0	4	14.3	21	35.6
20%	0	0	1	10.0	2	7.1	25	42.4
40%	3	100.0	8	80.0	20	71.4	10	16.9
60%	0	0	0	0	2	7.1	3	5.1
Total	3	100.0	10	100.0	28	100.0	59	100.0
Chi-square value- 29.97								
p value-0.0004* (significant)								

5. DISCUSSION

Quality of life and aesthetics is an increasingly important motivating factor for adults to seek orthodontic treatment¹¹. With labial metal braces being the most favoured appliance advocated by orthodontists, due to the ease and familiarity of the mechanics, helped little in the case of adults

seeking a more concealed option¹². About 82% of the adult participants showed some degree of concern regarding their smile and dental appearance (Figure 3), and approximately 85% of them were willing to undergo some form of fixed appliance therapy to improve the appearance of their smile (Figure 4).

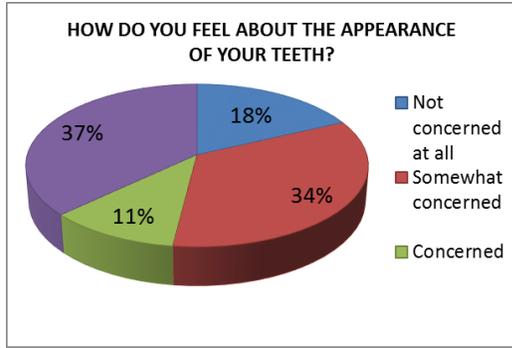


Fig. 3 Smile satisfaction amongst the sample population

When asked to rate the appliance based on their preference, 40% of the adults chose Clear Aligners as the first preference, 28% of the adults rated ceramic braces as the second best option

and approximately 60% of the adults regarded Stainless steel braces as the least desirable (Table 8, Figure 5).

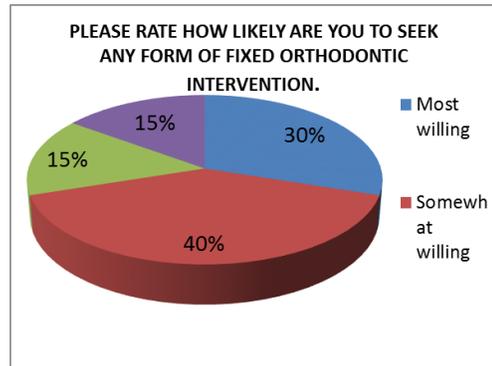


Fig. 4 Willingness to undergo any form of fixed orthodontic treatment

Table 8. Orthodontic appliance ranked on order of preference

	1 st preference		2 nd preference		3 rd preference		4 th preference	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Clear aligners	40	40.0	28	28.0	16	16.0	16	16.0
Clear ceramic braces	28	28.0	28	28.0	39	39.0	5	5.0
Lingual braces	11	11.0	29	29.0	40	40.0	20	20.0
Steel braces	21	21.0	15	15.0	5	5.0	59	59.0
Total	100	100.0	100	100.0	100	100.0	100	100.0

In spite of being concerned about the way their teeth look, people reported that the ‘train track’ appearance of the metal braces on the labial surface of the teeth made them conscious of wearing them and perceived that wearing them will adversely affect their confidence in a social situation¹³. Education status and income level seemed to impact the decision and the choice of individuals significantly.

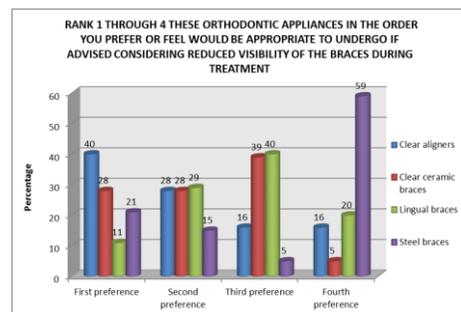


Fig. 5 Orthodontic appliance ranked in order of preference

People with higher education status showed increased interest in all the aesthetic appliances, especially 'Clear aligners' and ceramic braces. Most people expected lingual appliance to be most painful and difficult to maintain appliance, but preferred it over labial train-track appliance because of reduced visibility of the appliance on smiling¹⁴. Though the ceramic braces reduced the visibility of the braces significantly, they are still used with metal wires which are visible on the labial surface, therefore ceramic braces were not regarded as the true invisible appliance. For some people the fact that aligners could be removed from mouth by themselves and needed to be changed every 2 weeks was an aspect of concern¹⁵.

6. CONCLUSION

Approximately 80% of the adult patients who participated in the survey showed some degree of concern regarding the appearance of their teeth. Almost 80% of the adults were willing to undergo some form of fixed orthodontic treatment for correction of the teeth appearance. 40% of the people rated clear aligners as their first preference for orthodontic treatment and accepted a fee increase of up to 40 to 60%. 28% of the people rated ceramic braces as their first preference for orthodontic treatment and accepted a fee increase of up to 20 to 40%. Almost 70% of the adults considered stainless steel 'train-track' braces as the least preferred of all the options. Their perception of the appliance was affected by their level of education and income level.

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Appendix A - Information sheet for the Adult Patients

Information about the aesthetic appliances discussed in the questionnaire to reduce the visibility of the braces during orthodontic treatment.

<u>Appliance</u>	<u>Description</u>	<u>Photograph</u>
Steel 'train track' braces	<p>These are the most commonly and widely used braces, where the clips are stuck on the front surface of the teeth and the wires are connected to them.</p> <p>They have a classic 'Train-tracks' like appearance. They are unaesthetic as the metal is visible on smiling or talking.</p>	
Clear ceramic braces	<p>These are clear braces made of aluminium oxide (ceramic) material. Works on the same principle as metal braces and is as efficient as metal braces. They reduce the visibility of the braces on smiling due to tooth coloured appearance.</p> <p>They are brittle and may be prone to breakage. They are used with metal wires which are visible to certain extent.</p>	
Lingual braces	<p>These are metal brackets that are placed on the surface of the tooth facing the tongue. No wires or metal is visible on the front teeth.</p> <p>As the braces are placed towards the tongue, there can be tongue irritation and initial difficulty in speech. They are advised for less complicated cases as the finishing achieved is 10-15% lower than the metal braces.</p>	
Clear aligners	<p>It is the latest development and it involves wearing a series of customized clear plastic aligners for a minimum of 20 hours per day. They are changed on a two-weekly basis. A typical course of treatment takes approximately 25 aligners but varies according to the amount and complexity of</p>	

Clear aligners _____

6. Please rate how willing you would be to pay for orthodontic treatment with ‘train track’ metal braces.

Most willing _____

Somewhat willing _____

Somewhat unwilling _____

Most unwilling _____

7. Please rate how willing you would be to pay for orthodontic treatment with seamless clear ceramic braces.

Most willing _____

Somewhat willing _____

Somewhat unwilling _____

Most unwilling _____

If you would be willing, what percentage of increase in your orthodontic treatment fee would you be willing to pay for this aesthetic appliance?

10% ___ 20% ___ 40% ___ 60% ___

8. Please rate how willing you would be to pay for orthodontic treatment with seamless lingual braces.

Most willing _____

Somewhat willing _____

Somewhat unwilling _____

Most unwilling _____

If yes, what percentage of increase in your orthodontic treatment fee would you be willing to pay for this aesthetic appliance?

10% ___ 20% ___ 40% ___ 60% ___

9. Please rate how willing you would be to pay for orthodontic treatment with seamless clear aligners.

Most willing _____

Somewhat willing _____

Somewhat unwilling _____

Most unwilling _____

If you would be willing, what percentage of increase in your orthodontic treatment fee would you be willing to pay for this additional treatment?

10% ___ 20% ___ 40% ___ 60% ___

Would you be able to pay higher monthly payments to be treated with an aesthetic appliance?

Most able _____

Somewhat able _____

Somewhat unable _____

Most unable _____

10. Please check the appropriate fee increase for a particular reduction in the visibility of the appliance.

Reduced visibility of the appliance	Increase in fees by 10%	Increase in fees by 20%	Increase in fees by 40%	Increase in fees by 60%
10%				
20%				
40%				
60%				

11. What is the highest level of education attained in your family?

Less than high school _____

High school or less _____

More than high school but less than 4 years of college _____

4 years of college or more _____

12. Please check the category that best represents your total family annual income.

<Rs200,000 _____

Rs200,000-600,000 _____

Rs600,000-10,00,000 _____

>Rs10,00,000 _____

Additional comments

Thank you for completing our survey!