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**Original Research Article**

# Clear aligners - knowledge and preference among parents of children aged 10 - 17 years

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## ABSTRACT

**Background:** Clear aligners were introduced in the 20th century, but it did not gain popularity since there was a lack of promotion. However, now due to the widespread marketing on social media, clear aligners have gained popularity. Yet, the awareness about different types of clear aligners among parents was ambiguous. The aim of this study was to evaluate the knowledge and acceptance of clear aligners among the parents of children aged 10- 17 years.
**Methods:** The study was conducted on 50 parents of children aged between 10 to 17 years in Bengaluru. A Questionnaire was given to the parents to assess their knowledge about various orthodontic treatments and the different types of clear aligners. A video was shown to the parents which explained about the ideal age for orthodontic treatment, types of clear aligners, their advantages and disadvantages. After the video-demonstration, a questionnaire was given to the parents to assess their preference.
**Results:** On an average, the knowledge about different types of clear aligners among parents were low. Most of the parents were indecisive about choosing between In-office aligners and At-home aligners and unaware about the complications of At-home aligners. The study results showed that after video-demonstration, there was a statistically significant increase in the number of parents who chose 'In-Office' aligners over 'At-home' aligners (Mean value – 4.02).
**Conclusions:** This study helped in creating awareness about In-Office aligners, the various complications of At-Home aligners and also educated the parents in choosing a better treatment option for their children.

**Keywords:** Clear aligners, In-office aligners, At-home aligners, Orthodontic treatment, Malignment

## INTRODUCTION

Malocclusion is said to be the third most common dental anomaly, following caries and periodontal disease.[1] According to American Association of Orthodontics (AAO) almost 50% of the population in the developed countries has malocclusion. Malocclusion is a condition in which the normal and functional position of the teeth are altered.[2] Various harmful effects of malocclusion are manifested such as periodontal disease, difficulty in mastication, speech, and swallowing, increased risk of trauma, and poor aesthetics.[3] Scientific evidence shows that individuals with an aesthetic smile and normal occlusion have reported higher quality of life and confidence, compared to those individuals with malaligned teeth.

Orthodontics is a field of dentistry that helps in diagnosing, preventing, and treating the malaligned teeth.[4] There are two types of orthodontic treatment-

removable and fixed orthodontic treatment. Removable orthodontic treatment helps in correcting minor malalignment and spacing, whereas fixed orthodontic treatment helps in correcting major malalignment such as crowding, rotation, etc. The various fixed orthodontic treatments available are the Metal Braces, Ceramic Braces and Lingual Braces. However, they all have various disadvantages such as poor aesthetics, discomfort and difficulty in maintaining good oral hygiene.

Clear Aligners are a form of removable orthodontic treatment which can correct major malalignment. It is made of polyurethane plastics which is transparent. Thus, it provides good aesthetics during treatment and since it is removable, it helps the patient to maintain good oral hygiene without causing any discomfort.[5,6] Clear aligners were first introduced in the early 1940's but, it did not gain popularity because of the skepticism and lack of promotion. With the development of 3D technology and widespread marketing on social media, clear aligners became more popular.[7]

The finishing stages of orthodontic treatment requires the correction of minor irregularities of tooth position, which led to the introduction of the first ever clear aligners. The different brands of clear aligners are, e.g., Simplifive™, Clear aligner™, Clear path™, Smilelign, MTM Clear-Aligner™, Nimrodental Clear aligner™, Clear Image Aligners™, ClearAligner™, ClearCorrect™, Nuvola®, Fantasmino® or Invisalign™.[18,19] The advancement of clear aligner orthodontic protocols was done using materials available in the market, but there has been limited developmental work to introduce new materials dedicated for this purpose.

Thermoplastic materials, or a combination of materials are used to fabricate clear aligners because of their excellent properties. Some of the materials used to fabricate clear aligners are polyvinyl chloride, polyurethane, polyethylene terephthalate, and polyethylene terephthalate glycol. In addition to this, a virtual planning software is used for creating a set of clear aligners. This is done with the help of initial plaster impression (which is scanned in 3D) or direct digital 3D intraoral scan of the dentition. A model is created using 3D printing, for each aligner individually for stereolithography or material jetting. The next step involves fabrication of aligners by moulding the clear material over the 3D model of the patient's teeth (thermoforming or vacuum forming). The final stage involves trimming and polishing.

Energy consumption, waste management and environmental pollution are one of the many factors to be considered while opting for clear aligners. Excess waste material production following the current techniques has significant negative environmental effects and this is one of the setbacks in the Orthodontic department. The use of recycled materials in 3D printers would increase the sustainability of 3D printing technology and this would work as a long-term solution.

The two types of clear aligners are the In-office aligners and At-home aligners. Literature shows that, there are various complications due to At-home aligners, as it is not supervised by a specialist.[8,9] The extensive promotion of At-home aligners has gained public attention. However, the awareness about the different types of clear aligners among the parents was ambiguous. Therefore, the present study was conducted to evaluate the knowledge about different types of clear aligners among the parents of children aged 10- 17 years and their preferences.

## METHODS

This study was performed after obtaining approval from Institutional Review Board and Ethics Committee (IEC/MRADC&H/EC-050/2023), M. R Ambedkar Dental College and Hospital, Bengaluru. This study included fifty parents of children aged between 10 years and 17 years in Bengaluru. A written informed consent was obtained from parents. It is an interventional study and was conducted from March- 2023 to April- 2023 for a duration of 1 month.

### *Inclusion criteria*

Parents of children aged between 10 and 17 years and Parents who are willing to participate in this study.

### *Exclusion criteria*

Parents who are not willing to participate in the study and Parents of children aged below 10 years and above 17 years. The study was conducted in three phases.

### *Phase 1*

An e-Survey with a questionnaire of 20 questions was given to the parents, which helped to assess the parent's knowledge about various orthodontic treatment options, ideal age for orthodontic treatment, about clear aligners and the types of clear aligners.

### *Phase 2*

After phase 1, a video was shown to the parents which explained how a good smile will boost their child's confidence and about the ideal age of orthodontic treatment, about various orthodontic treatment options, various types of braces, their advantages and disadvantages. The video also explained about clear aligners, types of clear aligners such as In-office aligners and At-home aligners. It explained the various complications of At-home aligners since it is not been supervised by a specialist. This video helped the parents to gain precise knowledge about various clear aligners.

***Phase 3***

After phase 2, another e-survey with the same set of 20 questions was given to the parents. This phase was to assess the parent's knowledge after video-demonstration and to assess the acceptance of clear aligners and their preferences.

The data was tabulated and subjected to the following Statistical analyses performed using Package for Social Sciences (SPSS) for Windows Version 22.0 Released 2013. Armonk, NY: IBM Corp. Descriptive analysis of all the explanatory and outcome parameters was done using frequency and proportions for categorical variables, whereas in Mean and SD for continuous variables. Wilcoxon signed Rank test was used to compare the mean Pre and post-intervention scores among the study subjects. Kruskal Wallis Test was used to compare the mean Pre and post-intervention scores based on Occupational and Income status of the study subjects. The level of significance was set at $P<0.05$.

## RESULTS

The sample comprised of 50 parents of children aged between 10 and 17 years, out of which 62% were professional employees/workers, 26% were semi-professional employees/workers, and 12% were home-makers. (Figure 1).

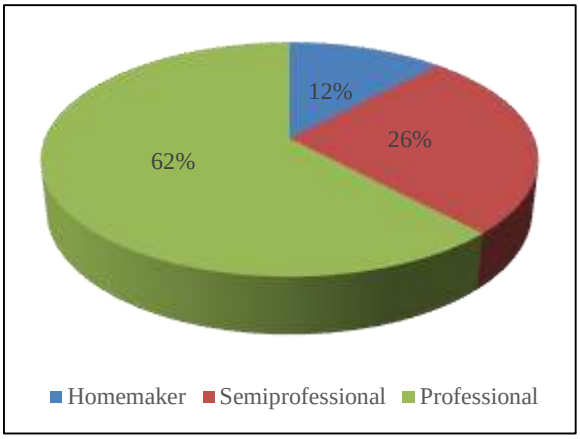


**Figure 1: Distribution of occupational Status of study subjects.**

The income status of the participants was obtained (based on B. G. Prasad's socioeconomic classification), out of which the income status of 18% was below 3 lakhs INR per annum, 16% was between 3- 5 lakhs INR per annum, 22% was between 5- 10 lakhs INR per annum, 44% was above 10 lakhs INR per annum (Figure 2).

***Questionnaire assessment***

Indicated that almost all the parents (90%) have been to a dentist, out of which all the parents (100%) were aware that a dentist can correct malalignment (Table 3).

In phase 1, 90% of the parents believed that a good smile could boost their child's confidence and after the video-demonstration, all the participants agreed to the former statement with a mean difference of 10% (Table 1).

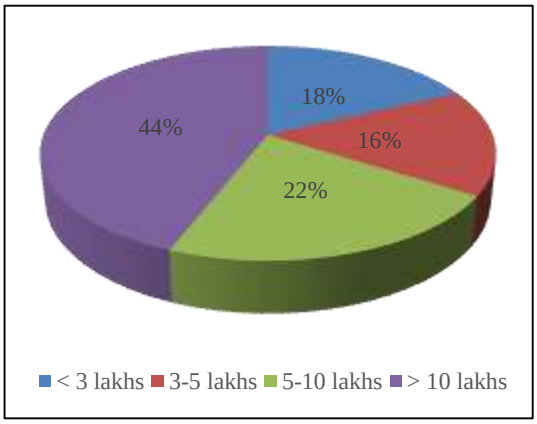


**Figure 2: Distribution of Income Status of study subjects.**

Among the 50 parents, 87.5% of the parents were aware about ideal age for the orthodontic treatment in phase 1, while in phase 3 of the study 100% of the study participants were aware about the ideal age for orthodontic treatment with a mean difference of 12.5% (Table 1).

Among the study participants, 46% of the participants were concerned about their child's appearance whilst undergoing conventional orthodontic treatment and only 70% of the participants knew about the clear aligners in phase 1. Only 40% of the participants preferred clear aligners in phase 1 and 60% of the participants were not sure about the efficacy of the clear aligners and opted for conventional orthodontic treatment also because clear aligners were expensive. Dentists and social media were the principal source of information about clear aligners for the participants. In phase 3 following video-demonstration, 74% of the parents preferred clear aligners with a mean difference of 34% (Table 1).

Although the participants had heard about the different brands of clear aligners through social media and dentists, their knowledge about the different types of clear aligners were low in phase 1. Seventy two percent of the parents were unsure about their preferences, while 14% of parents preferred In-office aligners and the remaining 14% preferred At-home aligners in phase 1 (Table 1).

Prior to phase 2, 24% of the parents were not aware that orthodontic treatment has to be done under a specialist and 44% of the parents were unaware that At-home aligners can result in unfavourable outcomes and complications, as it is not done under the supervision of a specialist (Table 1).

**Table 1: Distribution of the responses to the study questionnaire during pre and post intervention period among study subjects.**

| Questions | Category | Pre-Intervention | | Post-Intervention | | % Change |
|---|---|---|---|---|---|---|
| | | n | % | n | % | |
| **Have you been to a dentist before?** | Yes | 45 | 90.0% | 45 | 90.0% | 0.0% |
| | No | 5 | 10.0% | 5 | 10.0% | |
| **Are you concerned about your child's appearance?** | Yes | 46 | 92.0% | 46 | 92.0% | 0.0% |
| | No | 4 | 8.0% | 4 | 8.0% | |
| | Sometimes | 0 | 0.0% | 0 | 0.0% | |
| **Do you think a good smile can boost your child's confidence?** | Yes | 45 | 90.0% | 43 | 100.0% | 10.0% |
| | No | 0 | 0.0% | 2 | 0% | |
| | Maybe | 5 | 10.0% | 5 | 0% | |
| **Are you aware that a dentist can correct the misaligned teeth?** | Yes | 50 | 100.0% | 50 | 100.0% | 0.0% |
| | No | 0 | 0.0% | 0 | 0.0% | |
| **Have you heard of Braces/Clip treatment?** | Yes | 49 | 98.0% | 49 | 98.0% | 0.0% |
| | No | 1 | 2.0% | 1 | 2.0% | |
| **If yes, how did you get to know?** | Dentist | 23 | 46.9% | 23 | 46.9% | 0.0% |
| | Media, Newspaper, Magazines | 2 | 4.1% | 2 | 4.1% | |
| | Internet / social media | 9 | 18.4% | 11 | 22.4% | |
| | Friends / Family | 15 | 30.6% | 13 | 26.5% | |
| **Do you know the ideal age for braces/clip treatment?** | Yes | 28 | 56.0% | 47 | 94.0% | 38.0% |
| | No | 22 | 44.0% | 3 | 6.0% | |
| **What do you think is the ideal age for braces/clip treatment?** | 6-9 yrs. | 2 | 5.0% | 0 | 0.0% | 17.3% |
| | 10-12 yrs. | 22 | 55.0% | 34 | 72.3% | |
| | 13-15 yrs. | 13 | 32.5% | 13 | 27.7% | |
| | 16 yrs. and above | 3 | 7.5% | 0 | 0.0% | |
| **Are you concerned about the appearance during Braces/clip treatment?** | Yes | 23 | 46.0% | 23 | 46.0% | 0.0% |
| | No | 7 | 14.0% | 7 | 14.0% | |
| | Sometimes | 20 | 40.0% | 20 | 40.0% | |
| **Do you know that Invisible braces are available for children?** | Yes | 35 | 70.0% | 50 | 100.0% | 30.0% |
| | No | 15 | 30.0% | 0 | 0.0% | |
| **If yes, how did you get to know?** | Dentist | 15 | 40.5% | 28 | 56.0% | 15.5% |
| | Media, Newspaper, Magazines | 6 | 16.2% | 6 | 12.0% | |
| | Internet / social media | 9 | 24.3% | 9 | 18.0% | |
| | Friends / Family | 7 | 18.9% | 7 | 14.0% | |
| **Would you prefer invisible braces over the normal braces/clip treatment?** | Yes | 20 | 40.0% | 37 | 74.0% | 34.0% |
| | No | 6 | 12.0% | 6 | 12.0% | |
| | Not sure | 24 | 48.0% | 7 | 14.0% | |
| **If no, why?** | Expensive | 2 | 33.3% | 2 | 33.3% | 0.0% |
| | Don't know the efficacy of invisible braces | 4 | 66.7% | 4 | 66.7% | |
| | None of the above | 0 | 0.0% | 0 | 0.0% | |
| **Have you heard about Invisalign and Invisalign first?** | Yes | 19 | 38.0% | 50 | 100.0% | 62.0% |
| | No | 31 | 62.0% | 0 | 0.0% | |
| **Have you heard about Toothsi** | Yes | 32 | 64.0% | 50 | 100.0% | 36.0% |

Continued.

| Questions | Category | Pre-Intervention | | Post-Intervention | | % Change |
|---|---|---|---|---|---|---|
| | | n | % | n | % | |
| **Aligners and other commercially available invisible braces?** | No | 18 | 36.0% | 0 | 0.0% | |
| **If yes, how did you get to know?** | Dentist | 8 | 22.9% | 23 | 46.0% | 23.1% |
| | Media, Newspaper, Magazines | 8 | 22.9% | 8 | 16.0% | |
| | Internet / social media | 17 | 48.6% | 17 | 34.0% | |
| | Friends / Family | 2 | 5.7% | 2 | 4.0% | |
| **Would you choose Invisalign or other DIY aligners such as Toothsi?** | Invisalign | 7 | 14.0% | 41 | 82.0% | 68.0% |
| | Toothsi and other DIY aligners | 7 | 14.0% | 7 | 14.0% | |
| | Not sure | 36 | 72.0% | 2 | 4.0% | |
| **If Toothsi/ other DIY aligners, why?** | Marketing | 8 | 24.2% | 1 | 14.3% | 50.2% |
| | At home service | 5 | 15.2% | 1 | 14.3% | |
| | Affordable price | 7 | 21.2% | 5 | 71.4% | |
| | None of the above | 13 | 39.4% | 0 | 0.0% | |
| **Are you aware that you need a specialist's supervision when undergoing treatment by clear aligner?** | Yes | 38 | 76.0% | 50 | 100.0% | 24.0% |
| | No | 12 | 24.0% | 0 | 0.0% | |
| **Do you know that DIY aligners or aligners like Toothsi without the supervision of the specialists may cause unfavourable results and complications?** | Yes | 28 | 56.0% | 50 | 100.0% | 44.0% |
| | No | 22 | 44.0% | 0 | 0.0% | |

**Table 2: Distribution of pre and post-intervention scores among study subjects.**

| Parameters | N | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| **Pre-Intervention** | 50 | 10.90 | 4.04 | 5 | 19 |
| **Post Intervention** | 50 | 14.92 | 1.93 | 11 | 18 |

**Table 3: Comparison of mean pre and post intervention scores among study subjects using wilcoxon signed rank test.**

| Parameter | N | Mean | SD | Mean Diff | p-value |
|---|---|---|---|---|---|
| **Pre-Intervention** | 50 | 10.90 | 4.04 | -4.02 | <0.001* |
| **Post Intervention** | 50 | 14.92 | 1.93 | | |

*Statistically Significant

In phase 3, knowledge about the different types of clear aligners were significantly high among all the participants, 82% of the parents preferred In-office aligners over At-home aligners and all the parents were informed about the complications of At-home aligners. The total mean score for phase 1 was found to be 10.90 with a standard deviation of 4.04 and mean score for phase 2 was found to be 14.92 with a standard deviation of 1.93 (Table 2). The mean difference between phase 1 and phase 2 was 4.02 (Wilcoxon Signed rank test), which was statistically significant with p value < 0.001 (Table 3).Comparison of mean scores of Phase-1 and Phase-3 based on the income status of the parents showed that there was a statistically significant change of preference among the parents with their income level of more than 3 lakhs (Mean difference - 4.4 with p value <0.75).

**Table 4: Comparison of mean pre and post intervention scores based on the income status of the study subjects using chi square test.**

| Parameter | Occupation | N | Mean | SD | Min | Max | p-value |
|---|---|---|---|---|---|---|---|
| **Pre-Intervention scores** | < 3 lakhs | 9 | 10.00 | 4.00 | 5 | 17 | 0.75 |
| | 3-5 lakhs | 8 | 9.88 | 3.80 | 5 | 15 | |
| | 5-10 lakhs | 11 | 11.00 | 4.45 | 5 | 18 | |
| | > 10 lakhs | 22 | 11.59 | 4.06 | 5 | 19 | |
| **Post Intervention scores** | < 3 lakhs | 9 | 13.89 | 1.45 | 12 | 17 | 0.19 |
| | 3-5 lakhs | 8 | 15.13 | 2.48 | 11 | 18 | |

Continued.

| Parameter | Occupation | N | Mean | SD | Min | Max | p-value |
|---|---|---|---|---|---|---|---|
| | 5-10 lakhs | 11 | 15.64 | 1.75 | 13 | 18 | |
| | > 10 lakhs | 22 | 14.91 | 1.90 | 12 | 18 | |

## DISCUSSION

Malocclusion has complications not just on the facial appearance of the child, but also on their oral health and self-confidence.[10-12]

In 2018, a study was conducted in Jeddah, Saudi Arabia, among adolescents and they found that 25% of the study participants were indicated for orthodontic treatment.[13] The awareness about malocclusion and the ideal age for orthodontic consultation among parents, plays a vital role in their child's orthodontic treatment. Early diagnosis will help in early treatment which provides a better prognosis.

In 2019, a study was conducted in Jordan among parents to evaluate the knowledge about early orthodontic treatment for their children. The study concluded that there was lack of knowledge among the parents and it was due to many reasons, the leading cause being limited education and awareness. These results were reliable with the findings of Moshkelgosha et al. study in which the results showed that parents of higher social class and higher education had better knowledge and attitude towards orthodontic treatment.[14,15]

The development of clear aligners has made the process of orthodontic treatment more comfortable for the patient. Marketing of clear aligners in the social media has made it very popular in recent times. The establishment of At-home aligners and their marketing by various celebrities have gained the public attention. The At-home aligners are cited to be 60- 70% cheaper than the In-office aligners and also has the convenience of undergoing the treatment at home. The treatment is done without the supervision of the specialist; thus, it might result in unfavourable results and complications. Despite the complications, patients are still gravitating towards At-home aligners due to its affordability and convenience.

The present study was conducted to assess the knowledge and the preference of clear aligners among the parents of children aged between 10 to 17 years. The findings of this study showed that on an average, the knowledge about different types of clear aligners among parents was low.

Among the study participants, 46% of the participants were concerned about their child's appearance while undergoing conventional orthodontic treatment and only 70% of the participants knew about the clear aligners in phase 1. Only 40% of the participants preferred clear aligners in phase 1 and 60% of the participants were not sure about the efficacy of the clear aligners and opted for conventional orthodontic treatment also because clear aligners were expensive. Dentists and social media were the principal source of information about clear aligners for the participants and in phase 3 following video-demonstration, 74% of the parents preferred clear aligners with a mean difference of 34% (Table 3).

Most of the study participants knew about clear aligners but the knowledge about the types of clear aligners and their advantages and disadvantages were not clear in the phase 1 of the study. Phase 2 helped the parents gain knowledge about the ideal age for orthodontic treatment for their child, the various orthodontic options, different types of clear aligners and the possible complications that could occur with usage of At-home aligners used without a specialist's supervision.

In Phase 1 and 2, 24% of the parents were not aware that orthodontic treatment has to be done under a specialist's supervision and 44% of the parents were unaware of the possible unfavourable outcomes and complications with use of At-home aligners, since there is no guidance from a specialist regarding its use.

In phase 3, however, knowledge about the different types of clear aligners was significantly high. As much as 82% of the parents preferred In-office aligners over At-home aligners. Information about the complications of At-home aligners was explained to all the participants.

Upon comparing the mean scores of Phase-1 and Phase-3 based on the income status of the parents (Based on B. G. Prasad's socioeconomic classification), it showed that there was a statistically significant change of preference among the parents with their income level of more than 3 lakhs (Mean difference – 4.4 with p value <0.75).

The study concluded that in phase 1, the parent's knowledge about early orthodontic treatment and the different types of clear aligners were low and they were not sure on choosing 'In-office' aligners over 'At-home' aligners, as the latter is expensive. Phase 2 educated the participants in knowing the complications of 'At-home' aligners and the various advantages of 'In-office' aligners compared to the conventional orthodontic treatment in terms of comfort. In phase 3, there was a statistically significant improvement in parent's knowledge about the ideal age for orthodontic treatment and also to choose the better treatment option for their children.

Since the survey was conducted through google forms, we were not able to conduct the study on population with no access to internet and smart phones. Similarly, the video-demonstration was made only in one language, so, the people who doesn't understand English language were unable to participate in the study.

## CONCLUSION

The study revealed that awareness about the types of clear aligners was low among the parents and the video demonstration helped them gain knowledge about orthodontic treatment as a whole which will help them to decide a suitable orthodontic treatment for their child/children.

***Recommendations***

The advantages and disadvantages of the various types of orthodontic treatment has been explained to the parents. This study will guide the parents in opting a better treatment approach for their children. This study also helped in educating the parents about the complications of the At-home aligners.

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