

Potential Factors influencing the frequency of Clear Aligners usage among Orthodontist in Madhya Pradesh - a Questionnaire based Survey

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Abstract:

Background: As the demand for esthetic treatments is increasing, more people are seeking alternatives to fixed orthodontic appliances. Clear aligners are an esthetic and comfortable option for orthodontic treatment and have gained immense popularity over the last decade. The present study evaluated the potential factors influencing the frequency of annual usage of clear aligners amongst Orthodontist practising in Madhya Pradesh.

Materials and Methods: 60 Orthodontists (Academician/ Private Practitioner or Both) practicing in Madhya Pradesh were assessed for their perspective on the potential factors influencing the frequency of annual usage of clear aligners. Orthodontists were randomly allocated to 2 groups depending upon patients treated by aligners per year (Group I- Orthodontist who had treated 5 or less patients per year, Group II- Orthodontist who had treated 5 or more patients per year). An Online survey using the Zoho Survey App was created with 16 multiple choice questions. The link of this questionnaire was sent via WhatsApp to the participants. The data collected was subjected to statistical analysis. Data was tabulated depending upon Orthodontist experience, Hands on course in aligner treatment, Orthodontist with patients who believe the devices is cost effective, Time Efficiency of Clear Aligners, Better Clinical Effectiveness of Clear Aligners as compared to conventional fixed appliance, Improved Oral hygiene, Favorable esthetic appearance, Better periodontal health, Lesser white spot lesions, Risk of root resorption and Post Orthodontic Treatment Stability of Clear Aligners.

Results: Orthodontist with experience of less than 5 years were found to do less aligner patient per year as compared to Orthodontist with 10 year experience for both groups. The rate of Orthodontists with a minimum of 10 years' experience, hands-on course in aligner treatment and those with patients who believed that the device was cost effective were significantly higher in Group 2 than Group 1. Moreover, the frequency of Orthodontists who reported that their patients had improved Oral hygiene, better periodontal health, lesser or no white spot lesions, efficient and faster treatment and favourable esthetic appearance were significantly higher in Group 2 than Group 1 ($P < 0.05$).

Conclusion: Favorable esthetic appearance, a minimum of 10 years' orthodontists' experience, better periodontal health, lesser or no white spot lesions, efficient and faster treatment and improved oral hygiene are associated with higher rate of clear aligner usage among Orthodontists in Madhya Pradesh.

Key Word: Clear Aligner; Orthodontist; Esthetics, Efficient Orthodontic treatment

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I. Introduction

Orthodontics has been inundated with a lot of new technology, new treatment modalities and newer paradigms of treatment. It often becomes challenging to keep abreast of newer and 'best practices'. However, in today's day and age it is crucial for a successful clinician "to adopt and adapt to the latest". The "future" thus depends on the ability to incorporate new, better diagnostic and treatment modalities into clinical practice. Aligners have become the treatment of choice, especially with the increasing number of adults seeking orthodontic treatment, as they are more comfortable and aesthetic as compared to conventional fixed appliances¹. Clear aligners were first introduced by Kesling², who developed a thermoplastic tooth positioner to progressively move teeth to improved positions.

21st century witnessed the emergence of Clear Aligners that has firmly established itself as a distinctive orthodontic solution. Although its extent and application of use has been the subject of deliberation across platforms, research of Orthodontic tooth movement using clear aligners is limited. However, the repertoire of cases being treated with aligners has expanded the envelope of what aligners can achieve realistically on the clinical terrain, and conventional thinking is bracing itself for a rethink! Advances in the quality of aligner materials, attachments and the introduction of a new force system, have expanded the range of treatment possibilities from severe crowding to more difficult extraction cases, open bite cases, and lower molar distalization cases³. Further they are comfortable, esthetically pleasing, hygienic and removable too.

Modern orthodontics is striving to offer patients a comfortable and pleasant treatment journey. However, Orthodontic treatment is inevitably accompanied by several adverse effects: orthodontic pain, anxiety and decreased oral health-related quality of life (OHRQoL). With decreased bulkiness and increased invisibility, it is conceivable that clear aligners could relieve those aforementioned adverse effects as compared to conventional fixed appliances. It has been revealed that patients receiving Clear aligners would experience less pain than those receiving fixed appliances.⁴

Miller et al.⁵ compared the first week of orthodontic treatment with Aligners and fixed appliances, reporting that the aesthetics, removability and small size of the aligners resulted in significant pain reduction and better functional and psychosocial differences as compared to patients treated with fixed appliances.⁵

Till date, no study has explored the factors that influence the frequency of usage of Clear aligners among Orthodontists in India and more specifically Madhya Pradesh. This manuscript intends to address this lacunae, from this part of the world. The present study evaluated the potential factors influencing the frequency of annual usage of clear aligners amongst Orthodontist practising in Madhya Pradesh.

II. Material and Methods

This Cross-sectional, Comparative and Observational Questionnaire based Survey Study was carried out in Department of Orthodontics & Dentofacial Orthopedics, College of Dental Sciences and Hospital on 60 Orthodontists practicing (Academician/ Private Practitioner or Both) in major cities of Madhya Pradesh, who met the inclusion criteria for a period of 3 months from May 2019 to September 2019. All the non practicing Orthodontist who have discontinued their practice were excluded from the survey. The participating Orthodontists were ensured about the confidentiality & secrecy of the data.

Sample size calculation: The sample size was estimated on the basis of a single proportion design. The target population from which we randomly selected our sample was considered 20,000. We assumed that the confidence interval of 10% and confidence level of 95%. The sample size actually obtained for this study was 15 Orthodontists for each group. We planned to include 60 Orthodontists (Group I-Orthodontist who had treated 5 or less patients per year, Group II- Orthodontist who had treated 5 or more patients per year) with 4% drop out rate.

Subjects & selection method: The study population was drawn randomly from Orthodontists practicing (Academician/ Private Practitioner or Both) in major cities of Madhya Pradesh mainly Indore, Bhopal, Jabalpur, Ujjain etc, who met the inclusion criteria.

Inclusion criteria:

1. Participant should hold MDS Orthodontics
2. Should be either practicing or attached to a college of Madhya Pradesh.

Exclusion criteria:

1. Non practicing orthodontist who have discontinued their practice

Procedure methodology

After clearance from the ethical committee of the college, this study was undertaken on 60 Orthodontists practicing (Academician/ Private Practitioner or Both) in major cities of Madhya Pradesh, who met the inclusion criteria. All the non practicing Orthodontist who have discontinued their practice were excluded from the survey. The participating Orthodontists were ensured about the confidentiality & secrecy of the data.

An anonymous Questionnaire consisting of **16 multiple choice questions (Table1)**, assessed for Reliability and Validity Index by two academicians was used to assess the factors influencing the frequency of clear aligners usage among Orthodontist in Madhya Pradesh. An online survey questionnaire was created using Zoho Survey App. The link of this questionnaire was sent via WhatsApp to the Orthodontists practicing in Madhya Pradesh. When a participant accessed the link, they were directed to the survey where a set of sixteen questions appeared sequentially. The information sheet contained details of this anonymous survey and with the assurance commitment that all replies would be kept confidential. Completion of the survey was construed as informed consent to participate in the study.

The questionnaire was sent to around 100 Orthodontists who are practicing in various cities of Madhya Pradesh out of which 60 responded to the survey. 22 visited the survey link but chose not to answer. The information collected was automatically processed to the spread sheet and the responses were subjected to statistical analysis. Data was tabulated depending upon Orthodontist experience, Hands on course in aligner treatment, Orthodontist with patients who believe the devices is cost effective, Improved Oral hygiene, better periodontal health, lesser or no white spot lesions, efficient and faster treatment, risk of root resorption, post treatment stability and Favorable esthetic appearance.

QUESTIONNAIRE
1 ORTHODONTIST EXPERIENCE : From how many years you are practicing as an Orthodontist? a.1-5 b. 5-10 c. 10-15d. more than 15
2. Which City you practice Orthodontics in? a. Indore b. Bhopal c. Jabalpur d. Ujjain e. Other
3. How many patients you have treated in a year with Aligners? a.0 b. 1-5 c. more than 5
4. Have you attended any hands-on course on Aligner treatment therapy? a. Yes b. No
5. Does your patient believe that the device is cost-effective? a. Yesb. No
6. Do you think that there is improved Oral hygiene with Aligners as compared to Conventional Fixed treatment? a. Yes b. No
7. Do you think that there is improved Periodontal health with Aligners as compared to Conventional Fixed treatment? a. Yes b. No
8. Whats your say on White Spot lesions post Orthodontic treatment with Aligners as compared to Conventional Fixed treatment? a. Present b. Minimal/ No
8. Do Aligners provide Favourable Aesthetic appearance? a. Yes b. No
9. Do u think Aligners are better in treatment efficieny as compared to conventional Fixed appliance? a. Yes b. No
10. On a scale of 1-5, how satisfied are you with the results obtained using Aligner therapy? a.1 b.2 c. 3 d.4 e.5
11. Does your patient complain about pain or any discomfort while undergoing Orthodontic treatment with Aligners? a. Yes b. No
12. Have you come across root resorption in patient undergoing Aligner therapy? a. Yes b. No
13. On a scale of 1-5, how stable are the results obtained using Aligner therapy? a.1 b.2 c. 3 d.4 e.5
14. What percentage of patients would you say you treat with Aligners? a.1-10 % b.10-20 % c. 20-30 %d. more than 50%
15 Has the number of cases you treat with Aligners changed over the past year? a. Yes b. No
16. If you don't use Aligners, Why not ? a. they don't give me the results I wantb. they cost too much c. I don't want to depend on my patients' compliance for treatment to succeed d. Staff not trained

Table No 1:Questionnaire used in the study

Statistical analysis

The data was coded and entered into Microsoft excel 2010 (Microsoft corp.), analyzed using excel 2010 and SPSS 20.0 for Windows (SPSS inc).The data analysis was performed according to descriptive statistics which is presented as frequencies (n) and percentages (%).The potential influencing factors influencing the frequency of annual usage of clear aligners were collected. Chi-Square test (the level of significance was set at $p < 0.05$) and multivariable logistic regression were used for analysis.

III. Result

A total of 60 respondents on a total of 100 completed the questionnaire. The response rate was 60%.In terms of demographics, respondents represented 3 major cities of Madhya Pradesh, the majority was from

Indore (59%) and other cities included Bhopal (23%), Jabalpur (14%), Ujjain (4%). Data of 60 Orthodontists was available for analysis. Two groups of Orthodontists were identified, 32 Orthodontist who had treated 5 or less patients per year (64%) [Group 1] and 28 orthodontists who had treated more than 5 patients per year (46%) [Group 2].

Orthodontist with experience of less than 5 years were found to do less aligner patient per year as compared to Orthodontist with 10 year experience for both groups. The rate of Orthodontists with a minimum of 10 years' experience, hands-on course in aligner treatment and those with patients who believed that the device was cost effective were significantly higher in Group 2 than Group 1. Moreover, the frequency of Orthodontists who reported that their patients had improved Oral hygiene, better periodontal health, lesser or no white spot lesions, efficient and faster treatment and favourable esthetic appearance were significantly higher in Group 2 than Group 1. (Table 2),.

Orthodontist Data	</=5 Patients Per Year N (%) N = 32	>5 Patients Per Year N (%) N= 28	P value
Orthodontist Experience >/=5 Y	14 (43.75%)	7 (25%)	0.065
Orthodontist Experience >/=10 Y	18 (56.25%)	21 (75%)	0.038*
Hands on course in aligner treatment	22 (68.75%)	21 (75%)	0.036*
Orthodontist with patients believe the device is cost effective	8 (25%)	11 (39.2%)	0.010*
Better Clinical Effectiveness of Clear Aligners	22 (68.75%)	21 (75%)	0.016*
Improved oral hygiene	14 (43.75%)	14 (50%)	0.036
Favorable esthetic appearance	20 (62.5%)	25 (89.2%)	0.028*
Better periodontal health,	14(43.75%)	15(53.57%)	0.011*
Lesser white spot lesions,	16(50%)	21(75%)	0.036*
Risk of root resorption	10(31.25%)	12(42.8%)	0.038*
Post Orthodontic Treatment Stability of Clear Aligners	8(25%)	9(32.1%)	0.055

*(P<0.05).Statistically Significant

Table no 2: Comparison between two groups of Orthodontists according to the annual number of treated patients

Multivariable regression analysis revealed that the favourable esthetic appearance (P value < 0.005; OR: 4.58; 95% CI: 1.51 – 13.07), Better Periodontal health (P value <0.006; OR: 4.35; 95% CI: 1.50 – 13.01), a minimum of 10 years' orthodontists experience (P value <0.012; OR: 3.28; 95% CI: 1.21 – 9.35), improved oral hygiene (P value < 0.047; OR: 2.74; 95% CI: 1.23 – 6.17) , lesser or No white spot lesions (P value <0.051; OR: 2.70; 95% CI: 1.25 – 7.18) and efficient and faster treatment (P value <0.053; OR: 2.69; 95% CI: 1.10 – 7.07) were independently associated with annual treatment of more than 5 patients with clear aligners. [Table 3]

Variable	P Value	Odd Ratio	95 % Confidence Interval (CI)
Favorable esthetic experience	0.005	4.58	1.51 –13.07
Better Periodontal health	0.006	4.35	1.50 -13.01
Orthodontist Experience >/=10 Y	0.012	3.28	1.21 – 9.35
Improved oral hygiene	0.047	2.74	1.23 – 6.17
Lesser or no white spot lesions	0.051	2.70	1.25 -7.18
Efficient and faster treatment	0.053	2.69	1.10 – 7.07

Orthodontist with patients believe the device is cost effective	0.078	2.69	0.96 – 7.86
Hands on course in aligner treatment	0.081	2.87	0.81 – 9.17

Table No 3 : Prediction of annual treatment of more than 5 patients with clear aligners among Orthodontist in Madhya Pradesh

IV. Discussion

Clear aligners have been used in orthodontics since 1946, when Dr. Harold Kesling introduced the use of a series of thermoplastic tooth positioners to align the tooth. Over the last 15 years, clear aligners have mainly evolved through new technologies and materials to expand the range of tooth movements. The key benefits of Clear aligners therapy are improved esthetics with higher patient acceptance and a better and comfortable quality of life. Clear aligner therapy causes less discomfort compared to a conventional fixed therapy, decreases the number and duration of appointments, and needs less emergency visits, as well as an improvement of the gingival and periodontal health indexes is seen.

The treatment with Clear aligners is usually performed in combination with other orthodontic auxiliaries and procedures such as attachments, interarch elastics, and interproximal reduction. However, there are some significant limitations in treatment of complex malocclusions, i.e., the limited root-movement control, the intermaxillary discrepancy correction, the anterior extrusion, and rotation movement. In addition, the reliance on patient compliance has also been reported as a significant variable for the outcome of CA treatment. The clinicians who want to use Clear aligners to treat their patients must rely on their own clinical experience, expert opinions, and limited published evidence-based results^{6,7}.

Till date, no Current Indian study is available which has explored and documented the potential factors that influence the frequency of usage of Clear aligners among Orthodontists in India and more specifically Madhya Pradesh. Thus the present questionnaire based survey study aimed to address this lacunae, from this part of the world. Additionally, it also evaluated the potential factors influencing the frequency of annual usage of clear aligners.

Efficacy and Efficiency of Clear Aligners: As the demand and interest toward the clear aligner system continue to grow, concerns remain regarding the efficacy and performance^{8,9}. To date, published data include little clinical research on the effectiveness and efficacy of clear aligners^{10,11}. Previous literature primarily includes case reports or descriptions of the product, making it difficult to objectively characterize the efficacy of clear aligner systems⁹.

Clinical Effectiveness of Clear Aligners: In 2005, Djeuet al.¹² conducted the first retrospective cohort study on the effectiveness of clear aligners, comparing the treatment results of Invisalign® patients with the results of conventional fixed braces using the American Board of Orthodontics grading system. They reported that both systems are equally effective in space closure, marginal ridge alignment and, root paralleling; however, the Invisalign® system is deficient in the correction of anteroposterior discrepancies, providing occlusal contacts, and posterior torque. Parallel to the previous study, Kassaset al.¹³ stated that in mild and moderate cases, the clear aligner system is efficient in leveling and aligning arches and in effectively correcting buccolingual inclinations, but it is not sufficient to provide ideal occlusal contacts. The deterioration in occlusal contacts is caused by the thickness of aligners, which interferes with the settling of the occlusal plane. Kravitz et al.⁸ evaluated the accuracy of tooth movement obtained by the Invisalign® system and reported that only 41% of the predicted tooth movement was achieved. The most effective movement was lingual constriction (47.1%), the least accurate was extrusion (29.6%), and only 33% of predicted rotation correction was achieved.

The lower canine is the most difficult tooth to control. Weihong et al.¹⁴ evaluated the effectiveness of the Invisalign system on mild to moderate cases treated with premolar extractions and compared the treatment results obtained with fixed appliances. Their results revealed that both systems can be used in the treatment of extraction cases, and that root angulation attained with clear aligners are adequate when proper attachments are to be used. However, it should be kept in mind that treating extraction cases requires experience and extensive knowledge of the system^{15,16}. The majority of the literature focuses on the effects obtained via the Invisalign system. Yildirimet al.¹⁷ investigated the efficacy of tooth movements obtained with clear aligner appliances. In their study, retrusion was found to be the most accurately obtained tooth movement followed by a rotation, fan-type expansion, and protrusion respectively. Retrusion of mandibular central incisors is considered to be the most accurate single-tooth movement, whereas the rotation of mandibular canine is the least accurate movement. Due to the lack of scientific data and poor methodologies of the available studies, results should be interpreted with caution. Further research is required in this field¹⁸.

Time Efficiency of Clear Aligners: Time savings is an important outcome for orthodontists in private practice because spending less time in the clinic with one patient and completing treatment earlier both pleases the current patient and allows the orthodontist to treat more patients¹⁹. Bushang et al.²⁰ investigated the

difference between conventional fixed appliances and Invisalign® aligners in terms of total treatment time and chair time in non-extraction patients. Total treatment time was found to be 67% lesser in the Invisalign® group. The short duration of treatment with aligners was asserted with the absence of the finishing and detailing phase, which can take up to 6 months with fixed appliances. On the contrary, in extraction cases, Invisalign® treatment duration is 44% longer as compared to fixed-appliance treatment¹⁴. Patients with good compliance are required to visit the orthodontist in 10–12 week intervals in aligner therapy, whereas 4–6 week intervals are inevitable when treating with fixed appliances. Therefore, more appointments are required in fixed appliances therapies. Also, the chair time is found to be significantly shorter in clear aligners group, allowing the clinician to treat more patients^{20,21}. Our study concluded that 22 Orthodontists i.e 68.75% , who did 5 or less Patients Per Year and 21 Orthodontists i.e 75% , who did more than 5 Patients Per Year believed that aligners were more efficient as compared to fixed Orthodontic treatment. Our study concluded that 14 Orthodontists i.e 43.75% , who did 5 or less Patients Per Year and 15 Orthodontists i.e 53.57% , who did more than 5 Patients Per Year believed that aligners were more efficient as compared to fixed Orthodontic treatment.(Table 2)

Effects of Clear Aligners on Periodontal Status and Oral Health As the number of adults treated with clear aligners increased, the periodontal effects of this treatment were found to be negative in the literature²²⁻²⁴. Use of clear aligners facilitates oral hygiene, thus improving the periodontal status and causing a decrease in plaque levels, gingival inflammation, bleeding upon probing, and pocket depth²². Fixed appliances and wires made plaque control difficult and had adverse effects on periodontal tissues, making orthodontic treatment a predisposing factor for periodontal diseases^{23,24}. However, according to the Han et al.²² study, patients treated with fixed appliances and clear aligners showed identical gingival and plaque index, with better oral hygiene education and regular plaque control. Clear aligners not only encourage better oral hygiene and periodontal health but also reduce plaque accumulation and white spot lesion growth. According to the study of Azeemet al.²⁵, orthodontic treatment with clear aligners showed a low incidence of newly developed WSL's.

This questionnaire collected information on the potential factors that influence the frequency of annual usage of clear aligners focusing not only on differences between orthodontists with different experience but also depending on number of patients treated per year. The questionnaire was responded by a higher number of Orthodontist with experience of less than 5 years although they were found to do less aligner patient per year as compared to Orthodontist with 10 year experience for both groups. The rate of Orthodontists with a minimum of 10 years' experience, hands-on course in aligner treatment and those with patients who believed that the device was cost effective were significantly higher in Group 2 than Group 1. Moreover, the frequency of Orthodontists who reported that their patients had improved Oral hygiene, better periodontal health, lesser or no white spot lesions, efficient and faster treatment and favourable esthetic appearance were significantly higher in Group 2 than Group 1.

Scope and Limitations of Treatment with Clear Aligners: Although the number and complexity of cases treated with clear aligners continue to increase, it is impossible to treat all kinds of malocclusions with this system. Clear aligners are convenient in mild to moderate crowding or diastema, posterior expansion, intrusion of one or two teeth, lower incisor extraction cases, and distal tipping of molars. Movements such as extrusion, severe rotation correction, molar uprighting and the closing of extraction spaces are considered to be more difficult to achieve with aligners. Even so, incisor extrusion, molar transition, and closure of extraction spaces are possible with the use of attachments in the Invisalign® system.

V. Conclusion

Our findings revealed that the favorable esthetic appearance, a minimum of 10 years' orthodontists' experience, improved oral hygiene, better periodontal health, lesser or no white spot lesions and efficient and faster treatment are associated with higher rate of clear aligner usage among Orthodontists in Madhya Pradesh.

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