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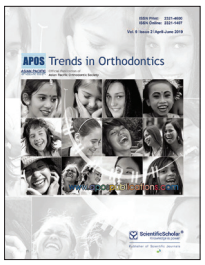

Original Article

Evaluation of augmented reality and social media on patient motivation to undergo fixed orthodontic treatment

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ABSTRACT

Objectives: The objective of the study was to primarily evaluate patient motivation towards doing orthodontic treatment after showing them AR filters. Secondly, the focus was to evaluate patient motivation toward doing orthodontic treatment after showing them their probable post-treatment smile through AR application and to evaluate the efficacy of AR in orthodontics in simulating orthodontic therapy and its final probable outcome.

Material and Methods: The data collected from individuals seeking orthodontic treatment was categorized on the level of interest in orthodontic treatment, the level of concern about appearance during treatment, the level of comfort to smiling with braces, the level of excitement about post-treatment smile, the level of willingness to post selfies or photos with braces on social media. Moreover, it was also categorized basis the level of influence of comments or messages from followers, the level of motivation to do the orthodontic treatment after seeing oneself with braces on filters, the level of impact of SmileView filter (By Invisalign India) on interest in orthodontic treatment by showing a probable post-treatment smile. Furthermore, the data was classified according to the level of satisfaction with SmileView probable post-treatment smile among 300 respondents, who rated each aspect on a scale of 1–5, where 1 means extremely reluctant, not bothered, apathetic or unsatisfied and 5 means very enthusiastic, very concerned, greatly influenced, or very satisfied.

Results: About 42% of patients were more enthusiastic about orthodontic treatment after showing SmileView results. Patients' preferences, social media participation, and 'braces look' acceptance had a significant association with the decision to initiate orthodontic treatment.

Conclusion: This study showed that potential orthodontic patients have varying attitudes and motivations for orthodontic treatment and that visual simulations can positively influence their interest, motivation, and satisfaction with orthodontic treatment.

Keywords: Augmented reality, Social media, Selfie, Fixed orthodontics, Patient motivation

INTRODUCTION

Augmented reality (AR) is a technology that overlays digital information in the real world, enhancing the user's perception and interaction with the environment. Patients are often reluctant to begin treatment as they are concerned about their esthetic appearance during

treatment.[1,2] In a study conducted in an orthodontic department in the South Asian region, it was found that 65% of patients had moderate anxiety, 25% had mild anxiety, and around 9% had severe to extreme anxiety.[3] Patients' age and education level had a significant association with the level of dental anxiety. Exposure therapy is one of the more effective ways to treat phobias and anxiety, which means showing the patient the anxiety-provoking stimulus. AR can help with exposure therapy for braces. In the broad sense, AR refers to "augmenting natural feedback to the user with mimicking cues." In this scenario, it would refer to the constructive procedure of placing virtual braces on the teeth of the patient to simulate ongoing orthodontic therapy. Hence, AR can enable exposure therapy and an opportunity for patients to "try on" braces before undergoing treatment.

AR has seen significant interest in the fields of medical education, healthcare, dentistry, restorative dentistry, and patient-doctor communication.[4,5] Doctors can use AR apps to better interact with people through immersive visualizations. AR can help doctors illustrate the procedure, show how the ailment is affecting esthetics and function, and explain how the procedure would help fix the ailment.[6] With customizable simulations prepared for various orthodontic procedures. Doctors could improve and ameliorate communication with cases of all periods and situations of specialized and medical knowledge.

AR can also help orthodontists communicate more effectively the result of the treatment of patients.[4] With AR, orthodontists can explain the treatment plan visually and interactively, making it easier for patients to understand the process and the expected outcome. By overlaying a digital image of the patient's projected smile onto their actual face, patients can get a realistic view of how their teeth will look after treatment. This can help patients make more informed decisions about their treatment and increase their satisfaction with their outcome.

MATERIAL AND METHODS

This study was conducted in the Department of Orthodontics and Dentofacial Orthopedics after approval from the Institutional Ethical Committee (Institutional Review Board [IRB] approval institute: Pravara Institute of Medical Sciences – Deemed University (IEC PIMS-DU). IRB approval number: PIMS/DR/RDC/2023/624). The period of the study was three months. A total of 300 subjects,including 159 female and 141 male patients who visited the Department of Orthodontics and Dentofacial Orthopedics and were willing to participate in the study, were selected according to convenient sampling. The data collected from individuals' level of willingness to post selfies or photos with braces on social media. We assessed for individual's level of getting influenced by comments or messages from followers, the level of motivation to do the orthodontic treatment after seeing oneself with braces on filters, the level of impact of SmileView filter (Invisalign India LLP, Sahar Plaza Andheri Kurla Road, Andheri[E], Mumbai, India) on interest in orthodontic treatment by showing a probable post-treatment smile, and the level of satisfaction with SmileView probable post-treatment smile. The individuals were asked to complete the questionnaire in the waiting area after verbal informed consent was obtained from each of the participants. The patients having difficulty understanding the questionnaire were guided in their queries. The questionnaire included 10 questions designed to understand the attitude of the patient towards social media, orthodontic treatment, and results. Each question could be answered on a scale of 1–5, with each question explaining the scale. The questionnaire was divided into 2 parts given to the subject before and after viewing the Simulated "braces-look" and simulated post-treatment smile.

Study design

This descriptive study included individuals willing to take part in the study and interested in receiving fixed orthodontic treatment and who need fixed orthodontic treatment according to IOTN criteria (Grade 2–4). The study also included those who needed orthodontic treatment and were exposed to social media regularly.

This study did not include individuals having severe malocclusion such as skeletal malrelation and Index of orthodontic treatment needs (IOTN) score of Grade 5 and individuals without social media exposure.

Methodology

This study comprised 300 patients visiting the Department of Orthodontics and Dentofacial Orthopedics who satisfied the inclusion criteria. After extraoral and intraoral examinations, patients explained the need for orthodontic treatment. Once the provisional diagnosis was done and the possibility of fixed orthodontics therapy was discussed, the patients were given the first questionnaire. Subsequently, their probable post-treatment smile was shown to them with the help of the SmileView filter. The probable ongoing treatment "braces look" was shown to them from a Snapchat filter simulating the patient's smile with braces on. As shown in [Figure 1] after some patient motivation, the second questionnaire was asked about their smile due to their changed/unchanged perspective toward braces look and fixed orthodontic treatment.

Questionnaire I

1. How often do you post images of yourself (selfies) on social media?
2. On a scale of 1–5 how much do you want orthodontic treatment?

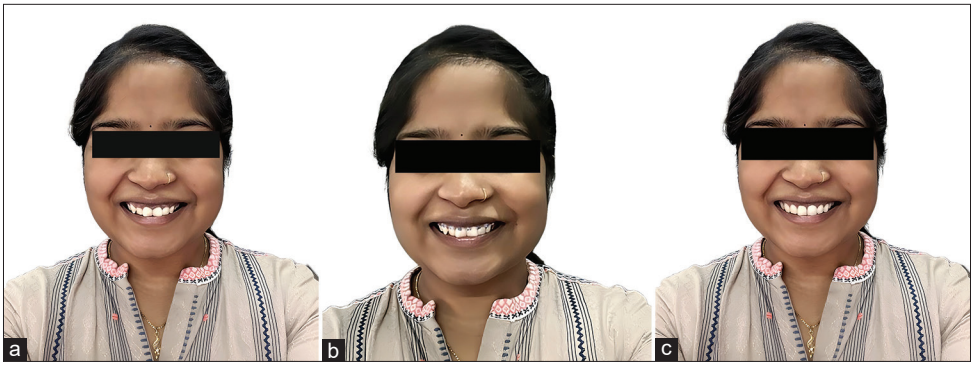

Figure 1: (a) Patient photograph before fixed orthodontic treatment. (b) Patient photograph with simulated braces look. (c) Patient photograph after probable post treatment result.

Table 1: Responses from participants for posting the selfies on social media.

	Posting selfies on social media		Chi-square	*P*-value
	Before AR	After AR		
Options				
Almost daily	7	8	489.576	<0.001*
Never	9	6		
Once a month	153	162		
Once a week	9	108		
Rarely	115	9		
Twice a week	7	6		
Total	300	300		

AR: Augmented reality. *P<0.05.

Table 2: Comparison of responses from the patients before and after AR.

	Mean	Std. Deviation	Chi-square	*P*-value
Q2	3.1800	0.95427	588.684	<0.001*
Q3	3.4800	0.89008		
Q4	3.1500	0.91119		
Q5	3.9192	0.83840		
Q6	3.0100	1.07413		
Q7	2.5433	0.97534		
Q8	3.3000	0.99665		
Q9	3.4141	0.85436		
Q10	3.7980	0.87742		

Std. Deviation: Standard deviation, AR: Augmented reality, *P<0.05.

3. How worried are you about your appearance during treatment?
4. On a scale of 1–5 how much would you like to smile with braces?
5. How excited are you about your post-treatment smile?

Questionnaire II

6. Would you like to post your selfies or photos with braces on social media?
7. Would comments or messages from your followers affect your decision?
8. After seeing yourself with braces on filters, are you motivated to do the orthodontic treatment?
9. Has the simulated post-treatment smile boosted your interest in orthodontic treatment by showing your probable post-treatment smile?
10. Would you be satisfied with your simulated post-treatment smile?

Statistical analysis

Statistical analysis was done with the Statistical Package for the Social Sciences (SPSS) (IBM SPSS Statistic for Windows, version 21.0. Armonk, NY: IBM Corp.) at 95% confidence interval and 80% power to the study. Descriptive statistics were performed in terms of mean, standard deviation frequency, and percentage. Pearson's Chi-square test was used for statistical analysis. Statistical significance calculated at $P < 0.05$.

RESULTS

The data shows how 300 respondents rated their interest in orthodontic treatment, their concern about appearance during treatment, their comfort with smiling with braces, their excitement about post-treatment smile, their willingness to post selfies or photos with braces on social media. Moreover, the respondents also rated their influence of comments or messages from followers, their motivation to do the orthodontic treatment after seeing themselves with braces on filters, their impact of SmileView application on their interest in orthodontic treatment by showing their probable post-treatment smile, and their satisfaction with their SmileView probable post-treatment smile on a scale of 1–5. [Figure 2]

Figure 2: (a) Graphical representation of responses for question number 1. (b) Graphical representation of responses for question number 2. (c) Graphical representation of responses for question number 3. (d) Graphical representation of responses for question number 4. (e) Graphical representation of responses for question number 5. (f) Graphical representation of responses for question number 6. (g) Graphical representation of responses for question number 7. (h) Graphical representation of responses for question number 8. (i) Graphical representation of responses for question number 9. (j) Graphical representation of responses for question number 10.

the results showed that majority of participants (46.3%) were neutral about the orthodontic treatment (3), followed by fairly interested (26.7%) and somewhat reluctant (10.7%). Only a few were extremely reluctant (7.7%) or very enthusiastic (8.7%). Most respondents (38.3%) were moderately motivated to do the orthodontic treatment after seeing themselves with braces on filters (3), followed by quite motivated (33.7%) and greatly motivated (10.7%). Only a few were not bothered (7.7%) or slightly bothered (9.7%). There was a statistically significant difference observed after seeing on filters, with most of the participants becoming motivated by the filters ($P < 0.0001$).

Most respondents (41.3%) were moderately worried about their appearance during treatment (3), followed by quite concerned (34.7%) and very concerned (13.7%). Only a few are not bothered (3.7%) or slightly bothered (6.7%). Most respondents (46.3%) were neutral about smiling

with braces (3), followed by comfortable (25.7%) and uncomfortable (14.7%). Moreover, a few showed reluctancy (5.7%) or were very enthusiastic (7.7%). Most respondents (40.7%) were very excited about their post-treatment smile (4), followed by moderately excited (26.3%) and extremely excited (26.7%). Only a few were fully apathetic (1.7%) or slightly apathetic (3.7%). Most respondents (47.3%) were neutral about posting selfies or photos with braces on social media (3), followed by fairly willing (17.7%) and somewhat reluctant (11.7%). Only a small fraction was very reluctant (12.7%) or very enthusiastic (10.7%) [Table 1].

Most respondents (43.3%) were moderately influenced by comments or messages from followers (3), followed by slightly influenced (24.7%) and apathetic (16.7%). Only a small fraction was quite influenced (11.7%) or greatly influenced (3.7%). After the AR view, there was a statistically significant difference observed in the responses from the participants about their appearance during the treatment which further significantly motivated participants to undergo orthodontic treatment. It was observed that AR significantly had a positive effect on the patient's attitude toward orthodontic treatment ($P < 0.001$). Majority of the participants were excited about their post-treatment smile. Most respondents (41.3%) were moderately impacted by the SmileView application on their interest in orthodontic treatment by showing their probable post-treatment smile (3), followed by significantly impacted (36.7%) and greatly impacted (9.7%). Only a few were fully apathetic (3.7%) or slightly apathetic (7.7%) Most respondents (42.7%) were very satisfied with their SmileView probable post-treatment smile, followed by moderately satisfied (27.3%) and extremely satisfied (21.7%). Only a few were unsatisfied (2.7%) or slightly unsatisfied (4.7%). This was found to be statistically significant ($P < 0.001$) [Table 2].

DISCUSSION

The survey consisted of ten questions that measured the respondents' level of interest, comfort, excitement, social influence, motivation, and satisfaction regarding the orthodontic treatment on a scale of 1–5. The SmileView simulation app allowed the respondents to see a realistic and personalized projection of their post-treatment smile using their selfies.

The main findings of this study were:

The majority of the respondents (139 out of 300) were neutral about wanting orthodontic treatment, feeling comfortable smiling with braces, and posting their photos with braces on social media. The respondents who were very reluctant or very enthusiastic about orthodontic treatment were a minority (23 and 26 out of 300, respectively). This suggests that there was a wide variation in individual preferences and motivations for orthodontic treatment, which may be influenced by factors such as socioeconomic status, desire for upward social mobility, and availability of dental health services. The respondents were more excited about their post-treatment smile than their current smile or their smile with braces (80 out of 300 answered 5 for a post-treatment smile, compared to 23 for their current smile and 23 for a smile with braces). This suggests that they had a positive expectation of the outcome of orthodontic treatment and that they valued the esthetic improvement of their teeth. The respondents were not influenced by comments or messages from their followers on social media (50 out of 300 answered 1 and 74 answered 2). This suggests that they had high self-esteem and confidence in their own decisions or did not rely on social media for validation or feedback. The respondents were moderately motivated to do the orthodontic treatment after seeing themselves with braces on filters (115 out of 300 answered 3 and 101 answered 4). This suggests that they were responsive to visual simulations of their potential dental appearance. The respondents had a similar level of interest in orthodontic treatment after seeing their probable post-treatment smile using the SmileView application (124 out of 300 answered 3 and 110 answered 4). This suggests that the SmileView application was effective in boosting their interest in orthodontic treatment by showing them a realistic and personalized simulation of their future smile.

These findings have several implications for orthodontic practice and research. Primarily, they indicate that there is a need to understand the diverse factors that affect the perceived need and demand for orthodontic treatment among potential patients and to tailor the communication and education strategies accordingly. Secondly, they suggest that visual simulations such as filters and SmileView applications can be useful tools to enhance patient engagement and motivation for orthodontic treatment, as well as to provide realistic expectations and satisfaction with the results. Lastly, they highlight the importance of measuring the psychosocial effects of orthodontic treatment, such as self-esteem, social competence, and quality of life, in addition to the clinical outcomes. Overall, the study provides a compelling argument for the potential of AR in improving patient motivation and satisfaction in fixed orthodontic treatment. While more research is still needed to fully understand the impact of AR on patient confidence and engagement, the evidence presented in the article is promising and warrants further exploration.

Limitations of the study

This study has some limitations that should be acknowledged. The survey questions were self-reported and may be subject to response bias or social desirability. Second, the SmileView application was not validated against actual post-treatment outcomes or patient satisfaction. Therefore, further studies with larger and more diverse samples, objective measures, and longitudinal designs are needed to confirm and extend these

findings. Furthermore, the Snapchat filter used here to show patients their "braces look" was not the most accurate visual representation of how the brackets will look on their teeth.

CONCLUSION

This study investigates the attitudes and motivations of potential orthodontic patients using a survey and a SmileView simulation filter. The use of AR in orthodontics has the potential to revolutionize the field of orthodontics. As technology continues to evolve, we can expect to see even more innovative uses of AR in orthodontics and other areas of healthcare. This study showed that the use of AR can help patients overcome their dental anxieties and phobia of fixed orthodontic treatment by providing them with the effects of exposure therapy and a positive goal to look forward to. These findings have implications for improving patient communication, education, engagement, and outcomes in orthodontic practice. Future research should explore the psychosocial effects of orthodontic treatment using objective and longitudinal methods.

Ethical approval

The research/study approved by the Institutional Review Board at Pravara Institute of Medical Sciences- Deemed University (IEC-DU), number PIMS/DR/RDC/2023/624, dated 06/04/2023.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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