

A Behavioral Classification Framework for Orthodontic Patients: Understanding Demand, Compliance, Trust, and Treatment Response

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ABSTRACT

Background: The emphasis on both practical and esthetic results has led to a substantial evolution in orthodontic therapy. However, patient behaviour has a big impact on treatment success. This includes compliance, treatment desire, and trust in orthodontists. Based on these behavioural characteristics, orthodontic patients can be categorised in an organised way to improve outcomes and provide more individualised care. This study aims to develop a behavioral classification framework for orthodontic patients based on their treatment demand, trust in the orthodontist, compliance with treatment protocols, and treatment response.

Materials and Methods: A cross-sectional study was conducted among 100 orthodontic patients evaluated by their treating orthodontists and residents. A structured questionnaire assessed patient demand, trust, and compliance. Content validity ratio (CVR), content validity index (CVI), inter-rater, and intra-rater reliability analyses were performed. Data were statistically analyzed using SPSS.

Results: Patients were classified into five categories:

1. Idealists – High-demand, trusting, compliant, and positive responders.
2. Inconsistents – Moderate-demand, trusting, partially compliant, and variable responders.
3. Skeptics – Low-demand, distrustful, non-compliant, and limited responders.
4. Strugglers – High-demand, trusting, non-compliant, and moderate responders.
5. Unpredictables – Moderate-demand, trusting, compliant, but with unpredictable responses.

Statistical analyses confirmed the validity and reliability of the classification system.

Conclusion: The proposed behavioral classification provides a structured approach to understanding orthodontic patient behavior. It enables clinicians to tailor treatment strategies, improve patient adherence, and enhance overall treatment outcomes. Future research should explore interventions to optimize compliance in different patient categories.

Keywords: Behavioral classification , orthodontic patients , treatment compliance, aesthetic demand, smile

1. INTRODUCTION

Over the years, orthodontic therapy has seen substantial development and is now a fundamental component of contemporary dentistry. Orthodontic treatment aids in alleviating traumatic occlusal contacts, particularly in the areas of the incisors and canines¹. In addition to the practical advantages of enhancing occlusion and masticatory efficiency, the face's profile and convexity can give an estimate of the sagittal jaw relationship². Hence orthodontics is essential for strengthening psychological health and facial beauty. Diagnosis is mandatory while desinging the treatment objectives³. Due to social

pressures and the desire for a beautiful smile, patients seeking orthodontic treatment frequently make aesthetic enhancement their first priority^{4,5}. In order to achieve optimal results, the growing need for customised therapies requires a better comprehension of patient behaviours, expectations, and compliance.

Patient compliance is still a crucial factor in determining the outcome of orthodontic treatment, even with the introduction of clear aligners, lingual braces, and digital treatment planning. Achieving the intended effects requires adherence to wearing appliances, using supplementary devices such as elastics, and keeping appointments⁶. However, it is difficult to standardise therapy since patients exhibit a variety of behavioural patterns, levels of trust in their practitioners, and degrees of adherence to treatment regimens⁷. The need for a systematic classification method to group patients according to important attributes including demand, trust, compliance, and treatment response is highlighted by this diversity.

In dentistry, the concept of classifying patients is not new. Prosthodontics, for instance, has classified patients according to their psychological characteristics and capacity to adjust to dental prosthesis⁸. Similarly, paediatric dentists can customise their methods by classifying adolescents based on how they behave throughout dental procedures⁹. However, there is still a lack of research on systematic frameworks for patient classification in orthodontics. Patient motivation⁶, compliance⁷, and trust⁸ have been the main topics of previous research, but these factors have hardly ever been included in an all-inclusive classification scheme.

Patients undergoing orthodontic treatment frequently have varied aesthetic needs, ranging from minor adjustments to significant makeovers. Their willingness to follow treatment plans and consent to supplementary operations like extractions or surgeries is directly linked to these demands. For example, patients who have high expectations for their appearance might comply more to get results faster, while patients who have lower expectations might not be as motivated⁹. Patient behaviour is further influenced by clear communication regarding treatment goals and confidence in the orthodontist's skills¹⁰.

The present study aims to address this gap by proposing a behavioral classification system for orthodontic patients based on data collected from orthodontic residents and practitioners. Using a structured questionnaire, this study evaluates factors such as demand for treatment, trust in the clinician, compliance with protocols, and response to treatment. The findings aim to provide a practical framework for clinicians to predict patient behavior, personalize care, and enhance treatment outcomes. Furthermore, this classification could serve as a foundation for future research in patient-centered orthodontics, fostering a holistic approach to dental care.

2. MATERIALS AND METHODS

The study was conducted as a cross-sectional survey at Saveetha Dental College. The study protocol was reviewed and approved by the Institutional Ethical Review Board.

The sample size required for the study was a sample of 47 practitioners to evaluate 100 patients with malocclusion undergoing orthodontic treatment by keeping the power at 90% and significance level at 0.05 with an effect size of 0.45. Therefore we evaluated 100 patients undergoing orthodontic treatment to participate in the study and be evaluated by their treating doctors or orthodontic residents¹¹. A total of 68 orthodontic residents and practitioners participated in the study. They were instructed to complete a structured questionnaire immediately after each patient consultation, before meeting the next patient. This approach minimized recall bias and ensured the reliability of data collected.

The structured questionnaire (Figure 1a and 1b) assessed various factors of patient behavior and treatment compliance, including:

1. Demand for orthodontic treatment.
2. Trust in the orthodontist and treatment team.
3. Compliance with treatment protocols, such as wearing appliances and attending appointments. Patient responsiveness to instructions and willingness to undergo recommended procedures.

Figure 1a : Questionnaire collected from participants

The questionnaire that was given to the participants are as follows:

1. Doctor name
2. PATIENT NAME
3. AGE
4. Gender
5. TYPE OF ORTHODONTIC TREATMENT PATIENT UNDERGOING (Mention type of braces, extraction, non-extraction, appliance/ surgery/ use of elastics)
6. Stage of treatment:
 1. 0-6 months of treatment

2. 6 months -1 year of treatment
 3. More than 1 year
7. How would you rate the level of demand from your patients regarding the speed of treatment?
1. Very high
 2. high
 3. moderate
 4. low
 5. very low
8. How often do your patients request the latest orthodontic technologies or treatment options?
1. Very often
 2. often
 3. sometimes
 4. Rarely
 5. never
9. How important is cost to your patients when deciding on a treatment plan?
1. extremely important
 2. very important
 3. moderately important
 4. slightly important
 5. not important
10. How would you rate the overall trust your patients have in your expertise and recommendations?
1. Very high
 2. high
 3. moderate
 4. low
 5. very low
11. How often do your patients follow your treatment recommendations without seeking second opinions?
1. Always
 2. often
 3. sometimes
 4. rarely
 5. never

Figure 1b: Questionnaire collected from participants

12. How willing are your patients to ask questions or express concerns about their treatment?
1. very willing
 2. willing
 3. neutral
 4. unwilling
 5. very willing
13. How compliant are your patients with extraction recommendations?
1. always complaint
 2. mostly compliant
 3. sometimes complaint
 4. Rarely compliant
 5. never compliant
14. How often do your patients wear their orthodontic appliances or elastics as instructed?
1. Always
 2. often
 3. sometimes
 4. rarely
 5. never
15. How punctual are your patients in attending scheduled follow-up appointments?
1. always punctual
 2. mostly punctual
 3. sometimes punctual
 4. rarely punctual
 5. never punctual
16. How responsive are your patients when instructed to make changes or adjustments to their care routines?
1. very responsive
 2. responsive
 3. neutral
 4. unresponsive
 5. very unresponsive

The questionnaire was developed based on existing literature and expert consensus, ensuring face and content validity. Details of the questionnaire, including the specific questions and response options, have been described previously.

The data was computed in microsoft excel sheet and statistics was done using IBM SPSS software. Content validity ratio (CVR) and Content validity index (CVI) was done to assess the essentiality of individual items and the validity of content in questionnaire and the measurement instruments.

Content validity ratio (CVR), a measure of importance of scoring of the questionnaire items. It helps determine whether an item should be retained or discarded (0 – Not necessary; 1-Useful; 2- Essential) was evaluated with the formula:

$$CVR = (NE - N/2)/(N/2)$$

where NE= number of experts rated an item as essential; N = Total number of experts

Also, content validity index (CVI) to measure the representativeness (1 – Not representative; 2- Need major revisions to be representative; 3- Need minor revisions to be representative) and clarity (1- Not clear; 2- Need major revision to be clear; 3- Need minor revisions to be clear; 4- Clear) of scoring was evaluated. The following formulas were used to calculate CVI

$$CVI \text{ (Representative)} = NR / N$$

where NR= number of experts rated an item as representative; N = Total number of experts

$$CVI \text{ (Clarity)} = N_c / N$$

where N_c= number of experts rated an item as clear; N = Total number of experts

Intra-rater Reliability was done to assess the single rater's evaluations was done where a single examiner repeated the patient evaluation in the second visit of the same patient. Cohen's kappa was used for the same. Inter-rater reliability was done to measure the level of agreement between two practitioners on evaluating the same patient simultaneously.

3. RESULTS

Table 1: Content validity assessment of the question items in the questionnaire

Factors	Question	Content Validity Ratio (CVR)	Content Validity Index – Representativeness (CVI-R)	Content Validity Index – Clarity (CVI-C)
Demand	Q1	0.82	0.85	0.91
	Q2	0.85	0.80	0.96
	Q3	0.81	0.81	0.94
	Q4	0.62	0.54	0.82
	Q5	0.68	0.42	0.78
Trust	Q1	0.80	0.84	0.97
	Q2	0.94	0.81	0.95
	Q3	0.72	0.62	0.92
	Q4	0.86	0.57	0.85
	Q5	0.74	0.88	0.89
Compliance	Q1	0.81	0.86	0.95
	Q2	0.65	0.82	0.96
	Q3	0.89	0.84	0.92
	Q4	0.85	0.67	0.81
	Q5	0.54	0.61	0.78

The five question item in demand factor assessed for CVR, CVI-R, CVI-C showed the average value of >0.7. Similarly, the items in the trust factor showed a cumulative content validity value >0.7. The question items in compliance factor too had

an average content validity value >0.7 . However, the question items with values <0.8 were either reworded, rephrased, or removed.

Table 2: Inter-rater and intra-rater agreement for the construct validity of the questionnaire

Agreement	Kappa Value	p-value
Inter-rater	0.722	0.005
Intra-rater	1.000	0.001

There was a significant 72.2% agreement between the raters and 100% agreement within the raters

Table 3: Descriptive statistics

Parameter	Frequency	
Age of patient evaluated	21.8 $\pm$ 5.7 years	
Years of expertise of practitioner	6.4 $\pm$ 2 years	
Male/Female	46 Male	54 Female
Type of Orthodontic treatment		
MBT Bracket, Non extraction	19	
MBT Bracket, Non extraction, Elastics	13	
Orthognathic surgery	7	
MBT Bracket, Extraction	20	
Damon Bracket, Non Extraction	15	
Damon Bracket, Extraction	4	
Functional & Orthopedic appliance	11	
Expansion appliance	4	
Aligners	7	

Stage of the treatment	
0-6 months	34
6 months - 1 year	22
> 1 year	44

Table 1 represents the descriptive statistics of the study subjects. The mean age of the 100 patients evaluated in the study was 21.8 $\pm$ 5.7 years . The years of expertise of the practitioners evaluating the patient was 6.4 $\pm$ 2 years . Out of the 100 patients 46 were male and 54 were female. Out of the patients assessed 39 patients were treated with MBT braces out of which 22 patients had no extractions but 13 of them were having adjunctive elastic wear and 20 of the patients had therapeutic extraction of teeth for the purpose of orthodontic tooth movement. 7 of the patients had undergone orthognathic surgery or were planned for surgical correction. Damon prescription brackets were used in 19 patients out of which 4 patients underwent extraction. With or without brackets 22 patients were subjected to adjunctives such as functional , orthopaedic appliances or expansion appliances. Aligners were used in 7 of the total patients. Orthodontic treatment can range from 6 months to 3 years or even further and often there is patient burnout and change in attitude during the course of treatment. Amongst the patients evaluated in the study 34 patients was 0-6 months into treatment , 22 patients were 6 months -1 year into treatment and 44 patients were into treatment for more than 1 year.

Table 4 : Results of patient evaluated under category of demand, trust and patient compliance

Category : DEMAND					
Question:	Frequency				
The speed of treatment	Very high	High	Moderate	Low	Very Low
	30	31	29	6	4
Latest technologies or treatment options	Very Often	Often	Sometimes	Rarely	Never
	21	29	29	18	3
Cost as a factor in deciding type of treatment	Extremely important	Very important	Moderately important	Slightly important	Not important
	10	39	32	10	9
Category : TRUST					
Overall trust in practitioner expertise and recommendations	Very high	High	Moderate	Low	Very Low
	25	45	10	17	3

Seeking second opinions	Very Often	Often	Sometimes	Rarely	Never
	30	34	12	11	13
Asking questions and expressing concerns regarding treatment	Very Willing	Willing	Neutral	Unwilling	Very willing
	26	51	6	11	6
Category : PATIENT COMPLIANCE					
Compliant to extraction recommendations	Always compliant	Mostly compliant	Sometimes compliant	Rarely compliant	Never compliant
	17	46	18	15	4
Wearing adjunctive appliances or elastics	Very Often	Often	Sometimes	Rarely	Never
	21	43	19	15	2
Punctuality in attending scheduled appointment	Always punctual	Mostly punctual	Sometimes punctual	Rarely punctual	Never punctual
	22	35	17	17	9
Following instructions to make changes and care modifications	Very Responsive	Responsive	Neutral	Unresponsive	Very Responsive
	30	41	17	10	2

Table 5: Internal consistency (reliability) of the question items in the questionnaire

Question	Inter-question correlation	Cronbach's α if item deleted
Q1	0.417	0.432
Q2	0.401	0.631
Q3	0.522	0.465
Q4	0.157	0.702
Q5	0.138	0.718

Q6	0.512	0.433
Q7	0.648	0.529
Q8	0.257	0.724
Q9	0.351	0.402
Q10	0.187	0.735
Q11	0.485	0.513
Q12	0.519	0.466
Q13	0.333	0.451
Q14	0.159	0.786
Q15	0.918	0.638

The question items with inter-question correlation <0.3 were eliminated one by one and finally we landed with the internal consistency Cronbach's α value of 0.786. Two question items from demand and trust factor and one question item from compliance factor have been eliminated and we ended with a final questionnaire containing 10 question items. The overall Cronbach's α value was 0.786 which indicated a good internal consistency of the question items in the questionnaire.

Table 6: Classification

Classification Name	Characteristics	Description of patient
Idealists	High-Demand, Trusting, Compliant, Positive Responders	These patients exhibit a strong desire for treatment, trust in their healthcare providers, and a high level of compliance with treatment protocols. They respond positively to treatment, showing significant progress and satisfaction with the outcomes. They are likely to actively engage in their orthodontic care and follow through with recommended appointments and instructions.
Inconsistent	Moderate-Demand, Trusting, Partially Compliant, Variable Responders	This category includes patients with moderate levels of demand for treatment and trust in doctors. Their compliance with treatment protocols may vary depending on factors such as convenience, perceived benefits, and understanding of the treatment plan. Response to treatment may be variable, with some patients showing good progress while others may experience delays or challenges.
Skeptics	Low-Demand, Distrustful, Non-Compliant, Limited Responders	These patients have limited interest or demand for orthodontic treatment and may harbor distrust or skepticism towards healthcare providers. Compliance with treatment protocols is generally low, possibly due to lack of motivation, understanding, or other personal barriers.

		Response to treatment may be limited, with slower progress and lower satisfaction levels compared to other categories
Strugglers	High-Demand, Non-Compliant, Responders Trusting, Moderate	This group includes patients who express a strong desire for treatment and trust in doctors but struggle with compliance. Despite their enthusiasm for treatment and positive attitude towards healthcare providers, they may face challenges in adhering to treatment protocols consistently. Response to treatment may be moderate, with some progress achieved, but potentially slower or less predictable due to compliance issues.
Unpredictables	Moderate-Demand, Trusting, Compliant, Unpredictable Responders	These patients have moderate levels of demand for treatment and trust in doctors. They generally comply with treatment protocols, but their response to treatment may be unpredictable due to factors such as biological variability, unexpected complications, or individual differences in treatment outcomes. While they may exhibit good compliance and trust in doctors, the results of treatment may vary among individuals in this category. These categories provide a framework for understanding the diverse characteristics and behaviors of dental patients seeking orthodontic treatment, helping clinicians tailor their approach to meet the unique needs of each patient subgroup.

4. DISCUSSION

The study's key findings highlight orthodontic patients' diverse behavioural patterns in terms of treatment demand, trust in their practitioners, compliance to treatment protocols, and treatment response. The proposed classification system divides patients into five categories: Idealists, Inconsistent, Skeptics, Strugglers, and Unpredictables. These categories provide insight into patient behaviour, allowing orthodontists to tailor their approach to improve treatment outcomes. The findings show that patients with high aesthetic demands are more likely to comply, whereas those with low trust or skepticism are less likely to adhere to treatment protocols. Furthermore, the study emphasises the significance of understanding patient psychology in achieving positive orthodontic outcomes.

Patient classification has long been recognized as a crucial aspect of personalized healthcare, particularly in fields such as prosthodontics and pediatric dentistry, where behavioral frameworks guide clinical decision-making¹². Orthodontics, however, has traditionally focused on the biomechanical aspects of treatment rather than integrating behavioral classifications into practice¹³. Given that compliance and trust play significant roles in determining treatment success¹⁴, a structured classification system is essential. Patients who trust their orthodontists and exhibit high compliance are more likely to achieve favorable outcomes¹⁵. Conversely, those with skepticism or inconsistent adherence may require additional counseling and motivation strategies to improve compliance.

The proposed classification has implications for both academic research and clinical practice. In academia, understanding patient behaviors and compliance patterns can contribute to refining treatment protocols and improving educational curricula for orthodontic residents. The classification framework can also serve as a basis for further studies exploring patient

engagement and long-term treatment adherence. Clinically, a structured classification can aid in developing personalized treatment strategies, thereby enhancing patient satisfaction and efficiency in orthodontic care ³. For instance, patients classified as ‘Strugglers’—who exhibit high demand but low compliance—may benefit from additional reinforcement strategies such as behavioral interventions or digital monitoring tools¹⁶. On the other hand, ‘Skeptics’ may require more detailed consultations to build trust and ensure informed decision-making ⁸.

Psychological factors significantly influence a patient’s willingness to comply with orthodontic treatment. Factors such as self-perception, social influences, and past dental experiences play a role in shaping their attitudes toward treatment¹⁷. Patients with high aesthetic demands, for example, may be more compliant as they are highly motivated by the perceived benefits of treatment ¹⁰. Understanding these psychological drivers enables orthodontists to employ motivational interviewing techniques and behavior modification strategies to enhance treatment adherence ². Additionally, the classification system can be used to customize communication strategies, ensuring that patients receive information in a manner that aligns with their level of trust and compliance tendencies. Digital tools, such as mobile applications for appointment reminders and progress tracking, can further support compliance among less adherent patient groups. Despite its clinical relevance, this study has certain limitations. The classification system is based on self-reported and clinician-evaluated data, which may introduce observer bias. Additionally, external factors such as socioeconomic status, cultural background, and previous dental experiences were not extensively explored in this study, yet they may influence patient behavior and treatment response. Future research should incorporate longitudinal studies to assess the stability of patient classification over time and evaluate the effectiveness of targeted interventions for different patient categories. Moreover, expanding the classification framework to include psychosocial and demographic variables could provide a more comprehensive understanding of patient behavior in orthodontics.

In conclusion, this study emphasizes the need for a structured classification system to enhance patient management in orthodontics. By integrating behavioral insights into clinical practice, orthodontists can improve patient engagement, optimize treatment outcomes, and foster a more patient-centered approach to orthodontic care.

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