Research Square

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Factors Associated with Patient Satisfaction After Orthodontic Treatment: A Retrospective Cross-Sectional Study

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Research Article

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Abstract

Background

Patient satisfaction is a crucial outcome of orthodontic treatment and can be influenced by factors that occur before, during, and after treatment. Nevertheless, few studies have investigated patient satisfaction following orthodontic treatment in dental education institutions. This study aimed to evaluate patient satisfaction after orthodontic treatment and to identify factors associated with satisfaction among patients treated at a university-based orthodontic clinic.

Methods

A retrospective cross-sectional study was conducted among patients who completed orthodontic treatment at the Orthodontic Clinic, Faculty of Dentistry, Prince of Songkla University, between July 2018 and July 2020. Eligible patients were invited to complete an online questionnaire covering demographic characteristics, personality traits, treatment expectations, treatment-related experiences, and satisfaction after treatment. Descriptive statistics were used to summarize the data. Factors associated with satisfaction were explored using chi-square tests and multiple logistic regression analyses.

Results

A total of 210 patients completed the questionnaire. Overall satisfaction was high, with 99.1% of respondents reporting that they were satisfied or very satisfied with their treatment outcome. Satisfaction was highest for tooth alignment (96.6%) and lowest for social acceptance (73.3%). In multivariable analysis, a positive orthodontist–patient relationship, a favorable clinic atmosphere, acceptance of dental caries occurring during treatment, and higher levels of extraversion were significantly associated with overall satisfaction. Expectations before treatment were associated with satisfaction in specific domains but were not independently associated with overall satisfaction.

Conclusions

Patients treated in this dental education institution reported a high level of satisfaction following orthodontic treatment. Satisfaction was associated with both patient-related factors and treatment-related experiences, particularly the orthodontist–patient relationship, clinic atmosphere, personality traits, and acceptance of treatment-related adverse conditions. Understanding these factors may help orthodontic training institutions optimize the patient experience and improve the delivery of care.

Introduction

One of the goals in orthodontic treatment is to achieve patient satisfaction following the completion of treatment. Orthodontists aim to provide patients with satisfactory outcomes, including teeth alignment, facial aesthetics, function, emotion, and social acceptance. The satisfaction level after orthodontic treatment was found from 34% [1] to 95% [2] with overall satisfaction and 100% in the Dental Class III malocclusion patients [3]. This demonstrates that there is a wide range of patient satisfaction because the questionnaires and criteria used to measure it are distinct. Previous studies also found relationships between various factors and patient satisfaction, such as gender [4], age [4], personality traits [1, 5], and the relationship between patients and orthodontists [4, 6–10].

In marketing research, satisfaction is frequently defined as the result of comparing consumer expectations to the actual products or services received [11, 12]. This suggests, in orthodontic treatment, that expectations before treatment may have an impact on satisfaction after treatment. Literature review compiles theories of patient satisfaction. However, there is still no definitive conclusion, as several theories have been found to be inconsistent with marketing theories [13]. Thus, the study on the relationship between expectation and satisfaction remains inconclusive.

In addition, it was revealed that the consumer's experience during consumption influences satisfaction after consumption [11]. An abnormality occurring during orthodontic treatment, such as pain [14], dental caries [15], halitosis [16], and increased plaque formation [17], may contribute to patient dissatisfaction due to discomfort in the oral cavity and increased financial burden on patients.

Therefore, this study aimed to evaluate patient satisfaction following orthodontic treatment at a dental education institution and to identify factors associated with patient satisfaction before, during, and after treatment.

Methods

This retrospective cross-sectional study was conducted using a self-administered questionnaire as the research instrument. The questionnaire was constructed based on a review of the relevant literature, and conversations with patients who had completed treatment at the clinic. Figure 1 illustrates the conceptual framework of the study.

Three experts comprised two specialized orthodontists and one research methodology expert reviewed the questionnaire to determine its content validity. They evaluated the questionnaire using the content validity index (CVI), and the results indicated a CVI of 0.98. The internal consistency of the questionnaire was measured using Cronbach's alpha coefficient by 15 patients who completed orthodontic treatment within one year. These pilot participants were not included in the final study sample.

The questionnaire consisted of five sections: general information, personality traits, expectations before treatment, service factors or situational factors during treatment, and satisfaction after treatment. For the personality traits, a shortened 10-item measure of the Big-Five dimensions questionnaire developed by Gosling et al [18] was used. The questionnaire featured a seven-point response scale ranging from "strongly disagree" to "strongly agree." The classification of personality traits was categorized into three levels: high (responses encompassing "disagree strongly" and "disagree moderately"), average (responses comprising "disagree a little," "neither agree nor disagree," and "agree a little"), and low (responses encompassing "agree strongly" and "agree moderately"). Similar question components appeared in the sections on expectations before treatment and satisfaction after treatment. These included both overall and component-level factors (teeth alignment, facial esthetics, function, emotion, and social acceptance). Each question utilized a Likert scale ranging from very high expectation (5 points) to no expectation (1 point) for expectation and from very satisfied (5 points) to very dissatisfied (1 point) for satisfaction. The service factors or situational factors during treatment section included questions on opinions regarding sufficient information about treatment, orthodontist-patient relationships, clinic atmosphere, and satisfaction with treatment duration. For each query, a Likert scale was used. Finally, questions were posed regarding the occurrence of abnormal conditions and the acceptance of abnormal conditions that occurred during treatment including pain, dental caries, halitosis, and increased plaque formation. A pain score ranging from 0 to 10 was reported to assess pain intensity. Respondents were asked to self-report whether any abnormalities occurred during orthodontic treatment and if they are willing to accept these abnormalities. If the sample group did not report any such abnormalities, they were asked if they would be willing to accept any abnormalities that might have occurred during the past orthodontic procedures.

The target sample size was determined using a rule-of-thumb approach commonly applied in multivariable logistic regression studies. Considering the number of candidate predictors planned for inclusion and the exploratory nature of the study, a minimum sample size of 200 participants was considered adequate. The inclusion criteria for the sample group were patients who had completed treatment with orthodontic residents from July 2018 to July 2020, had complete treatment records, and were over 18 years old at the time of the questionnaire response. The exclusion criteria were patients who received orthodontic treatment combined with orthognathic surgery, cleft lip or/and palate patients, and patients who had received previous orthodontic treatment.

Based on the data from the orthodontic clinic at Prince of Songkla University, a total of 675 patients completed orthodontic treatment within the selected timeframe. Four hundred and ninety-five patients who qualified for the inclusion and exclusion criteria were randomly assigned using Microsoft Excel to make a simple randomization to determine the sequence of contact for questionnaire administration. The sample group was contacted via telephone to request permission to complete the questionnaire online using Google Forms. The questionnaire link was sent to them via text message. We then contacted patients

numbered from 1 to 387 and found that 210 patients provided complete responses to the questionnaire. Therefore, recruitment was discontinued after 210 complete responses had been obtained.

Statistical analysis

The frequency distribution of all sections of the questionnaire was analyzed using mean and standard deviation. For bivariate analysis, each Likert-scale variable was dichotomized according to its own median score. Responses above the median were categorized as high, whereas responses at or below the median were categorized as low. This approach was adopted to facilitate chi-square testing and logistic regression analysis. Variables with p-values ≤ 0.20 in the bivariate analysis were entered into a multivariable logistic regression model using a forward stepwise approach. This strategy was adopted to reduce the number of predictors relative to the sample size and improve model stability. SPSS (SPSS Inc, v15, Chicago, Illinois) software was utilized for the statistical analysis. The level of significance was set to 0.05.

Results

The Cronbach's alpha coefficient for the perceived service factors or situational factors during treatment section of the questionnaire was 0.729. The coefficient for expectations before treatment was 0.763, and for satisfaction after treatment, it was 0.840.

Of the 484 eligible patients selected for contact, 387 were successfully reached and invited to participate in the study. A total of 210 patients completed the questionnaire and were included in the final analysis, yielding a response rate of 42.4% based on eligible patients and 54.3% among successfully contacted patients. No missing data were observed in completed questionnaires.

The general data of the respondents are shown on Table 1, which consisted of 210 respondents, revealed that 164 of them (78.1%) were female. The average age at the beginning of treatment was 20.66 years, with the earliest respondent being 11 years old and the oldest being 52 years old. With 121 respondents (57.6%), those under 20 years of age had the highest proportion of individuals beginning treatment. The age categories of 20 to 29 years ranked second with 63 (30%), 30–39 years ranked third with 22 (10%), and 40 years and older ranked last with 4 (1.9%). Regarding education level at the start of treatment, 115 respondents (54.8% were pursuing or had earned a bachelor's degree. The main reasons for seeking orthodontic treatment were primarily related to aesthetic concerns, with 160 respondents (76.2%), In terms of responsibility for treatment expenses, 84 respondents (40.0%) were personally responsible.

Table 1
General data of the respondents (n = 210)

Variable	n	%
Gender		
Male	46	21.9
Female	164	78.1
Age at the start of treatment (years) (Mean ± SD; Min-Max)		
< 20 (16.04 ± 2.45; 11–19)	121	57.6
20–29 (23.22 ± 2.55; 20–29)	63	30.0
30–39 (33.72 ± 2.55; 30–39)	22	10.5
≥ 40 (48.25 ± 3.56; 43–52)	4	1.9
Education level at the start of treatment		
Lower than undergraduate	95	45.2
Undergraduate or higher	115	54.8
Main reason for seeking orthodontic treatment		
Aesthetic	160	76.2
Function	50	23.8
Responsibility for treatment expenses		
Themselves	84	40.0
Other(s)	126	60.0

The distribution of personality traits is presented in Table 2. One hundred and eighty-four respondents (83.6%) had a high level of extraversion, 199 respondents (94.8%) had a high level of agreeableness, 207 respondents had a high level of conscientiousness, 139 respondents (66.2%) had a low level of neuroticism, and 189 respondents (90.0%) had a high level of openness to new experiences.

Table 2
Personality trait of the respondents (n = 210)

Personality trait	n	%
Extraversion		
Low score	7	3.4
Average score	19	9.0
High score	164	87.6
Agreeableness		
Low score	2	1.0
Average score	9	4.3
High score	199	94.7
Conscientiousness		
Low score	0	0.0
Average score	3	1.4
High score	207	98.6
Neuroticism		
Low score	139	66.2
Average score	59	28.1
High score	12	5.7
Openness to New Experience		
Low score	0	0.0
Average score	21	10.0
High score	189	90.0

From Fig. 2, overall expectations before treatment had an average rating of 4.20 out of 5. It was found that 1.4% of patients had low expectation, 14.3% had neutral, 47.6% had high expectation, and 36.7% had very high expectation. After treatment, the average overall satisfaction rating was 4.50 out of 5. It was reported that 1.0% of patients were neither satisfied nor unsatisfied, 48.1% were satisfied, and 51.0% were very satisfied. No patients reported being dissatisfied or very dissatisfied.

Regarding expectations before treatment in terms of teeth alignment, facial aesthetics, function, emotion, and social acceptance, the proportions of patients with high and very high expectations were 90.0%, 64.8%, 90.9%, 89.1%, and 60.0% respectively. In terms of satisfaction after treatment, the proportions were 96.6%, 81.9%, 93.4%, 93.4%, and 73.3%.

Respondents reported receiving sufficient information about orthodontic treatment at a rate of 97.2%. They perceived their Orthodontists as friendly and having a good relationship at a rate of 99.5%. The clinic's atmosphere encouraged patients to continue treatment regularly at a rate of 98.1%. Respondents also reported that the duration of orthodontic treatment was longer than expected at a rate of 46.7%.

Abnormalities during treatment were reported to include severe pain during treatment (scored 7–10 out of 10) by 46.6%. No respondents reported a score of zero. During treatment, they reported having dental caries (28.6%), halitosis (37.1%), and increased plaque formation (60.5%).

Regarding acceptance of abnormalities during treatment, the results showed that 99.0% accepted pain during treatment, 73.3% accepted the occurrence of dental caries, 79.0% accepted halitosis, 86.7% accepted increased plaque formation.

Table 3 shows the p-value of the relationships between various factors and satisfaction through bivariate analysis. Variables with p-values less than or equal to 0.20 were selected for the multiple regression analysis.

Table 3
p-value of the relationship between various factors and satisfaction from bivariate analysis (n = 210)

Variables			Patient satisfaction					
			Overall	Tooth alignment	Facial aesthetic	Occlusion	Emotion	Social acceptance
General information		Gender	0.128*	1.000	0.468	0.195*	0.513	0.782
		Age (Median at age 20)	0.076*	0.043*	0.294	0.247	0.970	0.584
		Education level	0.203	1.000	0.170*	0.711	0.138*	0.143*
		Main reason	0.143*	1.000	0.984	0.329	0.329	0.625
		Responsibility for treatment expenses	0.612	0.119*	0.770	0.821	0.735	0.656
Personality trait		Extraversion	0.002*	0.210	0.002*	0.686	0.390	< 0.001*
		Agreeableness	0.107*	1.000	0.030*	0.028*	0.030*	0.072*
		Conscientiousness	1.000	1.000	0.452	0.012*	1.000	1.000
		Neuroticism	0.017*	0.230	0.020*	0.078*	0.018*	< 0.001*
		Openness to New Experience	0.009*	0.002*	0.001*	0.038*	0.152*	0.005*
Expectation		Overall	0.027*	0.599	0.136*	1.000	0.133*	0.008*
		Tooth alignment	0.214	1.000	1.000	1.000	0.370	0.212
		Facial aesthetic	0.622	0.425	0.013*	0.570	0.255	< 0.001*
		Occlusion	0.743	1.000	0.350	0.027*	0.120*	0.005*
		Emotion	0.037*	1.000	0.386	0.655	0.052*	< 0.001*
		Social acceptance	0.176*	0.247	0.034*	0.175*	0.175*	< 0.001*
Situational factors		Sufficient information about treatment	< 0.001*	0.064*	0.027*	0.024*	0.024*	0.023*
		Orthodontist-patient relationship	< 0.001*	0.014*	0.226	0.204	0.204	0.237
		Clinic atmosphere	< 0.001*	0.122*	0.040*	0.452	0.060*	0.090*
		Treatment duration	0.267	0.121*	0.664	0.475	0.727	0.297
	Occurrence	Pain	0.214	0.599	0.984	0.821	0.735	0.625
		Dental caries	0.613	0.410	0.650	0.027*	0.548	0.730
		Halitosis	0.619	1.000	0.715	0.109*	0.492	0.366
		Increased plaque formation	0.444	1.000	0.709	0.152*	0.492	0.551
	Acceptance	Pain	0.239	1.00	0.330	0.129*	1.000	0.463
		Dental caries	0.003*	0.016*	0.005*	0.058*	0.012*	0.021*

*Statistical significance at p-value < 0.2

	Halitosis	0.012*	0.162*	0.082*	1.000	0.081*	0.210
	Increased plaque formation	0.083*	0.236	0.308	0.407	0.407	0.807

*Statistical significance at p-value < 0.2

From the multiple regression analysis shown on Table 4, it was found that accepting the occurrence of dental caries during treatment was associated with overall and every specific component of satisfaction. Meanwhile, personality traits showed different associations with post-treatment satisfaction. Extraversion was associated with overall satisfaction and satisfaction in social acceptance component, while Openness to New Experiences showed an association with satisfaction in tooth alignment and facial aesthetics components. It was not found that expectations before treatment, both overall and specific components, were significantly related to overall satisfaction. Only specific expectations in each component had a significant effect on satisfaction in that component, including facial aesthetics, psychological and social acceptance components. Additionally, the orthodontist-patient relationship and the clinic atmosphere also were associated with overall satisfaction.

Table 4
Adjusted odds ratios (ORs) from multiple logistic regression models (n = 210)

Variables		Patient satisfaction (Adjusted OR (95%CI))					
		Overall	**Tooth alignment**	**Facial aesthetic**	**Occlusion**	**Emotion**	**Social acceptance**
Acceptance of dental caries		2.825 (1.335–5.977)*	12.533 (1.748–89.851)*	2.893 (1.336–6.265)*	5.061 (1.372–18.671)*	4.666 (1.379–15.929)*	2.404 (1.025–5.638)*
Age			0.077 (0.007–0.819)*				
Personality trait	Extraversion	4.231 (1.427–12.544)*					8.841 (2.764–28.277)**
	Agreeableness				5.085 (1.016–25.444)*		
	Conscientiousness				34.007 (2.447-472.664)*		
	Neuroticism					0.0300 (0.088–1.022)	
	Openness to New Experience		20.585 (3.051–138.900)*	5.241 (1.954–14.060)**			
Expectation	Facial aesthetic			2.270 (1.070–4.813)*			
	Emotion					10.322 (2.051–52.222)*	
	Social acceptance						17.729 (7.275–43.209)**
Orthodontist-patient relationship		2.878 (1.195–6.932)**					
Clinic atmosphere		5.936 (1.195–6.932)*					

*Statistical significance at p-value < 0.05, **Statistical significance at p-value < 0.001

Discussion

From this study, it was found that the general patient information based on the responses from the questionnaire consisted of 78.1% women and 57.6% of patients below the age of 20. When compared to a previous study which surveyed all patients who came for orthodontic examinations and treatments at the same location as this study, it was found that 77.3% were women and 41.4% were patients below the age of 18 [19]. The proportions of gender and age among the study respondents were similar. Therefore, the demographic characteristics of the respondents appeared comparable to those reported in previous studies from the same institution.

The proportion of respondents who reported being satisfied or very satisfied with the overall satisfaction after treatment was 99.0%, which was higher than the previous study that used a Likert scale, ranging from 78% [20] to 95% [2]. No patients reported being dissatisfied or very dissatisfied. Regarding the specific components satisfaction, there were patients who rated every component as dissatisfied or very dissatisfied, but these ratings were in the low range, ranging from 0.5% for tooth alignment, occlusion, and emotion to 2.4% for facial aesthetics. These proportions were lower than the previous study [4] in all components, except for the social acceptance component which did not survey. The component of tooth alignment had the highest satisfaction rate of 92.6%, whereas we found a satisfaction rate of 96.6% in our study, which can be considered to be similar. In terms of the average scores for satisfaction, it was found that the lowest average score for satisfaction was in the social component, which was 4.05 out of 5. This could be attributed to the period effect caused by the impact of the COVID-19 pandemic, as the respondents in this study were surveyed after they had removed their orthodontic appliances until the date of survey. There have been studies reporting job insecurity, lack of progress in job positions, and job loss directly related to the consequences of the pandemic [21]. The qualitative study on patients currently undergoing orthodontic treatment also reported that the impact of the pandemic has prevented patients from socializing and confined them to isolation during the outbreak period [22].

Acceptance of pain or chronic disease is a concept commonly studied in the field of psychology and abnormality management [23, 24]. Acceptance of abnormality refers to an individual's ability to acknowledge and embrace the presence of it without attempting to avoid it. One approach that creates acceptance of an abnormality is through education and information [25]. Gaining knowledge about the abnormality, its progression, available treatment options, and self-management techniques can empower patients and enhance their comprehension and acceptance of the condition. The acceptance measured in the questionnaire reflects the respondents' understanding, which may have been acquired from their orthodontist, as well as their attitude toward the abnormality during orthodontic treatment.

From the multiple regression analysis, it was found that the acceptance of dental caries during treatment is positively correlated with overall satisfaction and satisfaction with each component. The chi-square test showed that patients who accepted dental caries during treatment had a higher proportion of satisfaction compared to the dissatisfied group, which had a lower proportion of acceptance. However, the study could not identify the causative factors for this relationship, and previous studies did not investigate the acceptance of abnormalities during treatment, therefore further study may be necessary. We found the relationship between the younger age of respondent at the beginning of treatment and satisfaction aligns with a previous study [10].

The study by Al-Omiri and Alhaija in 2005 investigated the relationship between personality traits and post-treatment satisfaction using the Big-Five personality dimensions [1]. It showed a significant correlation between personality traits and overall satisfaction. In this study, we found that openness to new experiences was correlated with satisfaction in teeth alignment, facial aesthetics, occlusion, and social acceptance aspects. However, the previous study found that neuroticism was negatively correlated with satisfaction. The inconsistent findings may be from the use of different questionnaires variations in the number of questions used to measure personality traits, with the previous study using 60 questions compared to only 10 questions in this study.

In contrast to our expectation, no direct correlation was found between overall satisfaction and expectations before treatment. Very high and high expectations before treatment were found, but satisfaction after treatment was also high. This suggests that the treatment outcomes in this study were equal to or exceeded the treatment expectations, or that satisfaction in healthcare does not align with marketing theories. From Batbaatar et al.'s perspective, many patient satisfaction theories do not directly correspond to marketing satisfaction [13].

Limitation

This study has several limitations. First, the retrospective design required participants to recall their pre-treatment expectations and treatment experiences, which may have introduced recall bias. Second, the response rate was moderate, raising the possibility of non-response bias if patients with different levels of satisfaction were less likely to participate. Third, satisfaction was measured using self-reported questionnaires and may have been influenced by social desirability bias. Fourth, this study was conducted in a single dental education institution, which may limit the generalizability of the findings to other treatment settings such as private practices or public hospitals. In addition, the highly imbalanced distribution of the outcome variable may have contributed to sparse-data bias and should be considered when interpreting predictors with large effect estimates and wide confidence intervals.

Conclusion

Patients who received orthodontic treatment had a high overall satisfaction rate, 99.0%. Satisfaction with specific components varied from 73.3% to 96.6%.

Factors found to be significantly related to overall satisfaction included the orthodontist-patient relationship, the clinic atmosphere, and the acceptance of dental caries during treatment.

Factors associated with satisfaction with specific components included expectations before treatment, personality traits, and the acceptance of dental caries during treatment.

Declarations

Abbreviations

No abbreviation was used.

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki and all relevant institutional guidelines and regulations. Ethical approval was obtained from the Human Research Ethics Committee of the Faculty of Dentistry, Prince of Songkla University (EC6407-049). Informed consent was obtained from all participants prior to completing the questionnaire.

Consent for publication

Not applicable. The manuscript does not contain any individual person's data in any form (including images, videos, or identifiable information).

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

Authors' contributionsK.R. contributed to data collection, data curation, statistical analysis, visualization, and drafting of the manuscript.S.S. contributed to the study conception and design, supervision of the research project, interpretation of data, and critical revision of the manuscript.N.Y. contributed to the study conception and design, methodology development, statistical analysis, interpretation of data, and critical revision of the manuscript.All authors read and approved the final manuscript and agree to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Availability of data and materials

The datasets generated and analyzed during the current study are not publicly available due to institutional policy but are available from the corresponding author upon reasonable request.

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Figures

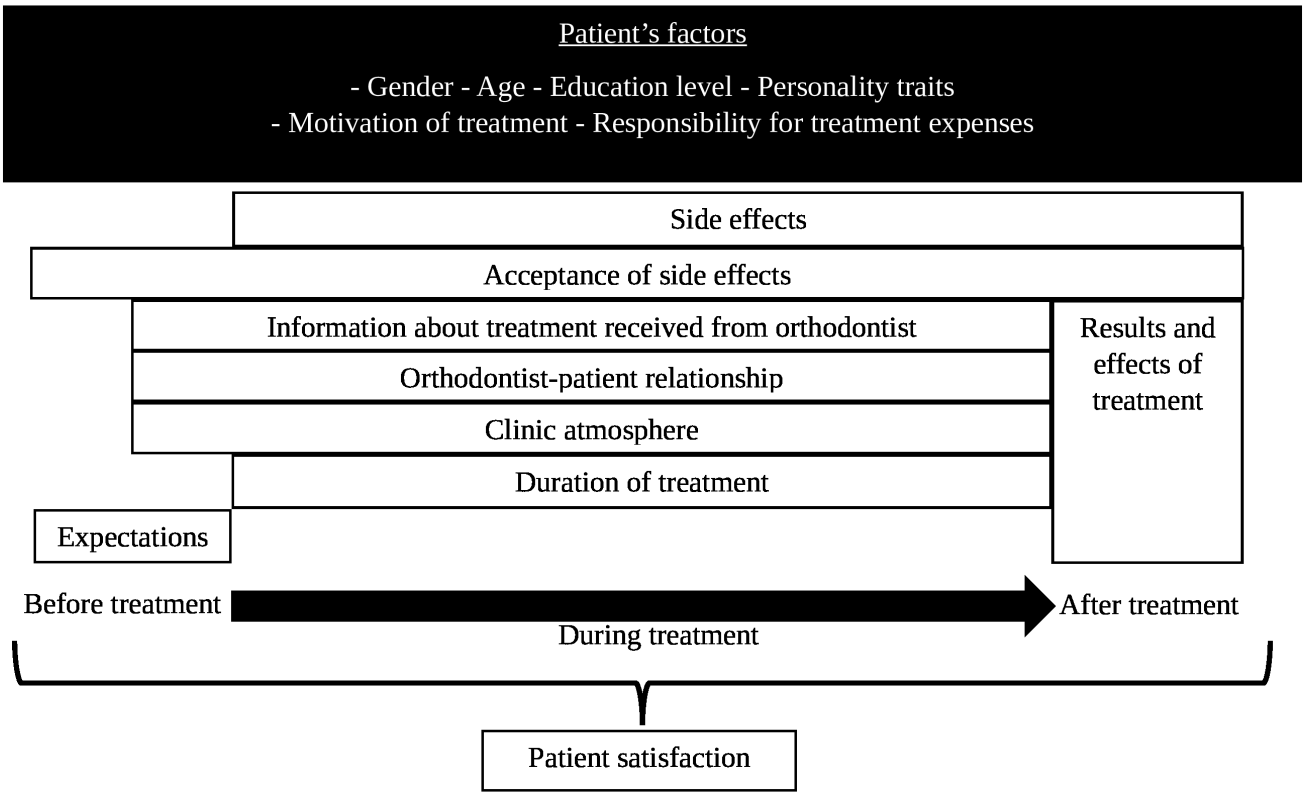
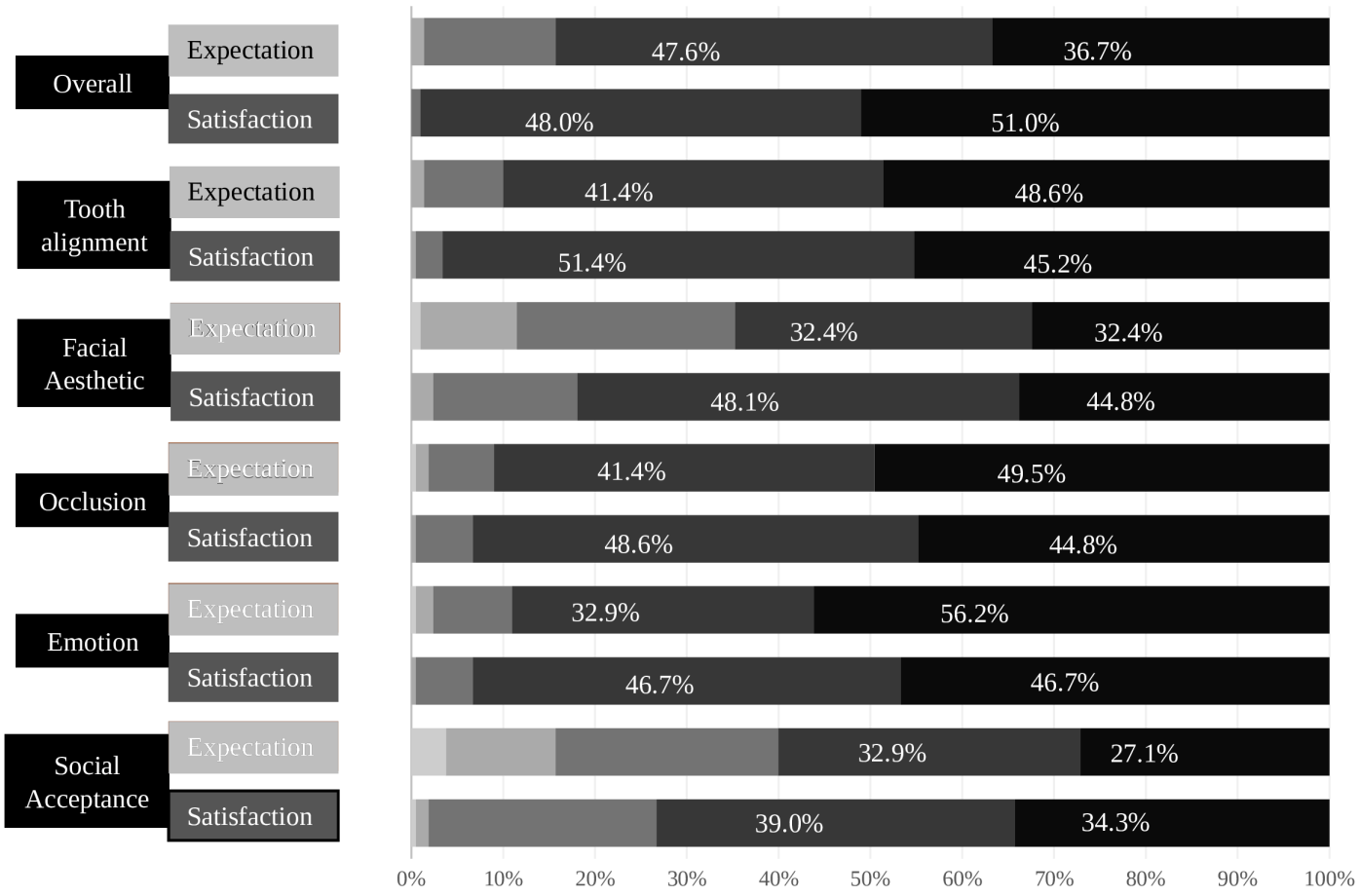


Figure 1

Conceptual framework of factors associated with patient satisfaction after orthodontic treatment



No expectation	Less expectation	Neutral	High expectation	Very high expectation
Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied

Figure 2

Expectation and satisfaction ratio of overall and specific aspects