



Original Article

Pain Perception, Knowledge, Attitude, and Diet Diversity in Patients Undergoing Fixed Orthodontic Treatment: A Pilot Study

Mok E-Vien¹, Ummi Sofia Binti Abdul Rahman¹, Snigdha Misra², Kirti Saxena³

¹IMU University School of Dentistry, Kuala Lumpur, Malaysia

²IMU Kuala Lumpur, Malaysia, and Jeffrey Cheah School of Medicine and Health Sciences, Subang Jaya, Malaysia

³IMU University School of Dentistry, Department of Orthodontics, Kuala Lumpur, Malaysia

Cite this article as: E-Vien M, Binti Abdul Rahman US, Misra S, Saxena K. Pain Perception, Knowledge, Attitude, and Diet Diversity in Patients Undergoing Fixed Orthodontic Treatment: A Pilot Study. *Turk J Orthod.* 2024; 37(3): 174-181

Main Points

- Majority of patients undertake orthodontic treatment to improve aesthetics and are internally motivated.
- Patients perceived most pain from separator placement, and least from taking impressions. Most patients experience pain on their teeth and mucosa while eating which is dull in nature and agree that orthodontic treatment affects their food intake.
- Majority of patients have good orthodontic knowledge and present with a positive attitude towards their treatment.
- Patients have a moderate diet diversity. The avoidance of some of the food groups, in some patients can be managed better by a nutritionist to overcome the dietary insufficiencies resulting in patient's overall wellbeing.

ABSTRACT

Objective: This study aimed to determine the correlation between pain perception and knowledge, attitude, and diet diversity in patients undergoing fixed orthodontic treatment.

Methods: A total of 103 patients (15-40 yrs.; 67 females, 36 males) undergoing orthodontic treatment with a 0.022-inch slot (MBT prescription) in both arches were recruited. Information on pain perception, knowledge, attitude, and diet diversity scores was collected through validated questionnaires using visual analogue scale and close-ended questions at one time point. The correlation between variables was analyzed using the Pearson's correlation coefficient.

Results: Of the patients, 48.5% were aged 15 to 19 years old, with 65% females and 73.8% of Chinese ethnicity. Approximately 90% of the orthodontic patients perceived low levels of pain from orthodontic treatment, and 98% had a positive attitude toward orthodontic treatment. The patients had a good level of knowledge (Mean: 6 ± 0.65). Approximately 49.5% of patients reported having moderate diet diversity. No significant correlation was found between pain perception and knowledge, or pain perception and diet diversity ($r=0.062$, $p=0.534$). However, a significant weak negative correlation ($r=-0.289$, $p<0.05$) between pain perception and attitude was observed.

Conclusion: Patients undergoing fixed orthodontic treatment presented with overall low pain perception, a positive attitude, and good knowledge about their treatment with moderate diet diversity. Informing the patient in advance about different orthodontic procedures encourages a positive attitude and facilitates patient cooperation. An interprofessional approach involving nutritionists can provide a holistic patient approach during orthodontic treatment.

Keywords: Pain perception, knowledge, attitude, diet, fixed orthodontic appliance

Corresponding author: Kirti Saxena, e-mail: saxenakirti@imu.edu.my

Received: January 27, 2023 **Accepted:** November 09, 2023 **Publication Date:** September 30, 2024



INTRODUCTION

Orthodontic treatment is often sought by patients to improve their aesthetics. The ideal clinical management of patients seeking fixed orthodontic treatment largely depends on the clinician's skills; however, patient cooperation, motivation, and compliance greatly contribute to treatment success. These factors, in turn, are influenced by pain perception, knowledge, attitude, and diet diversity.^{1,2}

The course of orthodontic treatment is commonly accompanied by pain and discomfort, with almost all patients claiming to have encountered some pain during their treatment.³ Discomfort is identified as light tactile pressure on the teeth, soft tissue stretching, pressure on the oral mucosa, tooth sensitivity, and pain⁴⁻⁶ Özkalaycı et al.⁷ have reported that patients undergoing orthodontic treatment experience eating difficulties and pain, which decreases over time. Even though the pain is mild and brief, many patients may discontinue treatment because of it.⁸⁻¹⁰ Pain perception, however, is subjective, with individual variations influenced by age, gender, pain threshold, stress, emotional state, and previous dental experience.^{3,5,9-11} Pain plays a major influence in patient compliance.⁷ An in-depth understanding of orthodontic treatment is important to ensure long-term cooperation by patients willing to undertake orthodontic treatment.¹² Well-informed patients with positive attitudes have been found to have been found to have fewer pain experiences and develop a positive attitude toward their treatment.^{1,3,6,13-15}

Orthodontists often advise patients to consume a soft diet to minimize pain and prevent appliance breakage, which may affect their nutritional status.¹⁶ Most orthodontic patients are adolescents, an age at which their nutrition should be optimal because they are in their period of rapid growth. A well-balanced diet is important for adolescents because the body requires sufficient nutrients to accommodate pubertal growth as well as emotional stress.¹⁷ Studies have reported that poor nutrition in orthodontic patients affects the biological response of the periodontal ligament and bone to orthodontic forces.¹⁸ The preferential intake of a soft diet during treatment results in reduced fiber and carbohydrate intake and an increased intake of fats.¹⁹ Kausal et al.²⁰ showed that this dietary modification has a positive impact, as patients adopt healthier eating habits consisting of boiled vegetables, mashed rice, and various juices. Although the orthodontic literature has dietary guidelines, its effect on patient diet diversity has been less studied. Understanding the patient's diet diversity during treatment will help identify patients in need of appropriate dietary guidance to avoid compromising their nutritional status.

Despite the many benefits of orthodontic treatment, it may negatively impact patient quality of life. Thus, further understanding of the patient's perception of pain, knowledge about orthodontic treatment, attitude, and diet diversity will enable the orthodontist to facilitate a more patient-centered approach for the success of orthodontic treatment.

The hypothesis posited is that patients undergoing fixed orthodontic treatment have a deficient perception of pain, insufficient knowledge, exhibited unfavorable attitudes, and have limited dietary diversity. Hence, the present study was designed to assess the perception of pain, knowledge, attitude, and diet diversity in patients undergoing fixed orthodontic treatment at a selected university dental clinic.

METHODS

This study was approved by the Joint Research and Ethics Committee of the International Medical University [grant no.: BDS I-01/2019(13)].

Study Protocol

A total of 103 participants were recruited, over five months from the active patient list of the Oral Health Centre at IMU University in Malaysia. Written informed consent was obtained from all patients. For patients aged below 18 years, consent was obtained from both the patient and their parents. The inclusion criteria were: (1) Patients undergoing orthodontic treatment with a 0.022-inch slot (MBT prescription) in both arches; and (2) agreeable to participate in the study and provide consent from themselves or through their guardians. The exclusion criteria were: (1) patients with a history of any craniofacial anomaly, systemic disease, or those who were on any medication. (2) inability to complete the questionnaire.

Study Instruments

A questionnaire was developed based on existing validated questionnaires. The questionnaire consisted of six parts: Socio-demographic information, pain profile,²⁰ pain expectation, pain experience,¹⁴ knowledge of patients on fixed orthodontics appliances,^{21,22} Patient's Attitude Toward Orthodontic Treatment (PATOT),¹⁴ and Diet Diversity Questionnaire.²³ Most of these questions consisted of close-ended questions and visual analogue scales (VAS), which were easily comprehensible by the patients. All questions were translated and back-translated into Bahasa Malaysia and Mandarin. A brief oral examination was conducted, and the orthodontic treatment records were checked to document the patient's stage of orthodontic treatment. All patients were briefed about the study, and a researcher was available to counter any patient queries.

The questions on pain perception included questions regarding location, duration, timing, type, pain relief method, effect on daily routine, diet, social behavior, and psychological temperament. VAS has been found to be an easy, reliable, sensitive, and convenient method for measuring pain intensity.¹² Pain experience and expectations regarding the orthodontic procedures were assessed using the VAS marked on a 0-10 scale with 0 representing "No hurt" and 10 representing "Hurts most" for different orthodontic procedures. Each patient was instructed to mark the line nearest to their expectation or experience.

The scores for pain expectation and pain experience were averaged to obtain the final pain perception score. A patient with a higher score indicates greater pain experience during the treatment.¹⁴

The knowledge domain comprised seven statements. All participants were asked to indicate whether they agree or disagree with the statements. The items were scored such that "Agree" was scored 1 and "Disagree" was scored 0, and the mean was calculated for the knowledge component.²¹ "Agree" corresponded to a higher level of knowledge about their treatment.

PATOT was used to study the attitudes of the patients. The questionnaire consisted of twelve statements that were assessed using the VAS on a scale of 0-10, with 0 representing "Extremely Unlikely" and 10 representing "Extremely Likely" for different orthodontic procedures. The variables for each statement were rescored such that a high score corresponded to a positive attitude toward fixed orthodontics.¹⁴

Diet diversity was measured through a qualitative 24-hour recall of all foods and drinks consumed by the participants. "1" was scored in the column next to the food group if at least one food from this group was consumed by the respondent on the previous day. Diet diversity was assessed using a score based on the Individual Dietary Diversity Score (DDS). The score ranges from 0 to 9. A score of ≤ 3 is considered as having a low diet diversity, 4-5 is considered moderate, and ≥ 6 is considered as high diet diversity.²³

Statistical Analysis

The statistical analysis was performed using IBM SPSS 23.0 Software. Descriptive statistics, including frequency, percentage, and mean, were used to describe the characteristics of the survey respondents. Kolmogorov-Smirnov test was used to test the normality of the data. The independent t-test was used to determine gender dimorphism. The correlation between pain perception and knowledge, attitude, and diet diversity in patients undergoing fixed orthodontic treatment was analyzed using Pearson's correlation coefficient. The sample size required for the study was determined using G*Power 3.1.9.7 software. Assuming an effect size of 0.25, significance level of 0.05, and power of the study of 0.80, the minimum number of samples required was 95.

RESULTS

Table 1 shows the sociodemographic distribution of the recruited orthodontic patients. Most (48.5%) of the patients were aged 15 to 19 years, with the majority being female (65%) and of Chinese ethnicity (73.8%). The main reason for undergoing orthodontic treatment was to improve esthetics (68.9%), and most (59.2%) patients were internally motivated. A similar distribution of all stages of fixed orthodontics was observed, with most patients (37.9%) in the leveling and

alignment stage, followed by space closure (35.9%) and finishing (26.2%).

Perception of Pain from Orthodontic Treatment

Table 2 shows the pain profile of the orthodontic patients. The majority (80.6%) experienced dull pain, primarily in their teeth (55.3%) and mucosa (43.7%) while eating (66%). The pain occurred occasionally (51.5%) lasted for a few hours (38.8%) and most patients (65%) did not use any means to relieve it. Most (59.2%) patients reported that pain from orthodontic treatment affected their food intake.

Table 3 presents the pain perception of the patients. Lower scores indicate less intensity of pain experienced/expected from orthodontic treatment, whereas higher scores indicate more intense pain.¹⁹ Although most pain was reported due to separator placement (4.17 ± 3.24), it was of low intensity. The least pain (1.65 ± 2.4) was perceived during impression-taking.

Knowledge of Orthodontic Treatment

The patients' knowledge level regarding their orthodontic treatment are shown in Table 4. Most respondents agreed with statements like, "Orthodontic treatment improves

Table 1. Socio-demographic characteristics of the patients

Parameters	Total, n (%)	
Gender	Male	36 (35.0)
	Female	67 (65.0)
Age group (yrs.)	15-19	50 (48.5)
	20-24	34 (33.0)
	25-29	14 (13.6)
	30-34	2 (1.9)
	35-40	3 (2.9)
Ethnicity	Malay	11 (10.7)
	Chinese	76 (73.8)
	Indian	4 (3.9)
Concerns regarding orthodontic treatment	Esthetics	71 (68.9)
	Improve dental hygiene	23 (22.3)
	Improved chewing efficiency	7 (6.8)
	Others	2 (1.9)
Motivation	Internal	61 (59.2)
	Parents	28 (27.2)
	Peers	5 (4.9)
	Dentist	7 (6.8)
	Others	2 (1.9)
Treatment stages	Leveling and alignment	39 (37.9)
	Space closure	37 (35.9)
	Finishing	27 (26.2)

esthetics" (99%), "Orthodontic treatment corrects teeth and jaw abnormalities" (98.1%); "Incomplete treatment may lead to more problems" (96.1%), and "Retainer wear is important after orthodontic treatment (95.1%)". A few patients (29.1%) disagreed with the statement, "Orthodontic treatment duration is long," which still shows a higher level of knowledge in most patients. In the present study, most participants had good levels of orthodontic knowledge (Mean: 6±0.65).

Table 2. Characteristics of pain

Characteristics	Parameters	Total number of participants (%)
Pain areas	Teeth	57 (55.3)
	Mucosa	45 (43.7)
	TMJ	1 (1.0)
Time of pain occurrence	Day	18 (17.5)
	Night	12 (11.7)
	While eating	68 (66.0)
	While speaking	5 (4.9)
Duration of pain	Few minutes	25 (24.3)
	Few hours	40 (38.8)
	Full day	20 (19.4)
	A few days later	18 (17.5)
The type of pain	Dull	83 (80.6)
	Throbbing	20 (19.4)
Frequency of pain	Continuous	50 (48.5)
Pain relief	Occasional	53 (51.5)
	Medication	6 (5.8)
	Topical anesthesia	3 (2.9)
	No treatment	67 (65.0)
	Relief wax	27 (26.2)
Effects of pain	Yes, n (%)	No, n (%)
The daily routine	21 (20.4)	82 (79.6)
Effects of food intake	61 (59.2)	42 (40.8)
Social behavior	17 (16.5)	86 (83.5)
Psychological temperament	14 (13.6)	89 (86.4)

Attitude toward Orthodontic Treatment

Table 5 shows the patient attitudes toward treatment. Lower scores indicated a negative attitude toward orthodontic treatment, whereas high scores indicated a positive attitude toward it.¹⁴ The majority of patients scored 8.80±1.77, more inclined to disagree with the statement, "Orthodontic treatment often has no use at all" showing a more positive attitude toward their treatment. The mean score of 5.32±3.04 for the statement "When you wear braces, you need to adjust your dietary habits" was the lowest among all statements, indicating that patients had a slightly positive inclination toward their treatment. Most patients exhibited a positive attitude toward their treatment. A significant difference (p<0.05) between sexes was observed regarding the statement, "It is not required to visit an orthodontist after your braces have been removed".

Diet Diversity among Patients Undergoing Orthodontic Treatment

Table 6 depicts the consumption patterns of different food groups along with gender dimorphism. No significant difference in the consumption patterns of all food groups between genders was reported.; Vitamin A-rich vegetables and tubers, white tubers and roots, Vitamin A-rich fruit, other fruits, organ meats, legumes, nuts, and seeds were "not consumed" by many of the subjects. Approximately 6.8% of patients had a score of ≤3 indicating a low diet diversity range; 49.5% had a moderate diet diversity score, and 43.7% had a high diet diversity score (≥6).

Based on the results of our current study, no correlation was be found between pain perception and knowledge, as all patients had a good level of knowledge. Similarly, no correlation was observed between pain perception and diet diversity among patients undergoing orthodontic treatment (r=0.062, p=0.53). However, a significant but weak correlation (r=-0.289, p=0.003) between pain perception and attitude was observed.

DISCUSSION

The present study included 103 patients undergoing orthodontic treatment at Oral Health Centre at IMU University in Malaysia. Most patients were adolescent (15 to 19 years)

Table 3. Pain perception of the participants

	Procedures	Total	Male	Female	*p-value
		Mean ± SD	Mean ± SD	Mean ± SD	
Pain perception	Separators	4.17±3.24	5.05±3.33	3.69±3.14	0.135
	Bands	3.57±2.96	4.11±2.73	3.29±3.07	0.343
	Bonding brackets	2.13±2.61	2.11±2.49	2.13±2.69	0.965
	Wire change	2.92±2.79	2.78±3.03	3.00±2.67	0.701
	Elastics	4.01±2.52	4.03±2.57	4.00±2.51	0.963
	Retainers	2.35±2.39	2.31±2.42	2.37±2.39	0.891
	Impression taking	1.65±2.40	1.61±2.38	1.67±2.43	0.903
	Debonding	2.16±2.18	2.14±2.06	2.16±2.26	0.953

Independent t-test was used and *p<0.05 was considered as statistically significant, SD: Standard deviation

Table 4. Mean orthodontic knowledge among orthodontic patients

	Parameters	Response	
		Agree, n (%)	Disagree, n (%)
Domains knowledge	Orthodontic treatment improves esthetics	102 (99.0)	1 (1.0)
	Orthodontic treatment is expensive	98 (95.1)	5 (4.9)
	Orthodontic treatment corrects tooth and jaw abnormalities	101 (98.1)	2 (1.9)
	Orthodontic treatment duration is long	73 (70.9)	30 (29.1)
	Important to adhere to the food guidelines established by orthodontists	92 (89.3)	11 (10.7)
	Incomplete treatment may lead to additional problems	99 (96.1)	4 (3.9)
	Retainer wearing is important after orthodontic treatment	98 (95.1)	5 (4.9)

Table 5. Attitude of the patients toward orthodontic appliances

	Parameters	Total	Male	Female	*p-value
		Mean ± SD	Mean ± SD	Mean ± SD	
Attitude	The use of braces causes a lot of trouble	5.47±2.43	5.31±2.15	5.55±2.57	0.625
	When wearing braces, you should adjust your dietary habits	5.32±3.04	4.81±2.82	5.60±3.13	0.209
	Orthodontists always advise that patients must wear braces more often than necessary	6.14±3.10	5.42±3.18	6.52±3.01	0.085
	Orthodontic treatment is often of no use	8.80±1.77	8.81±1.95	8.79±1.68	0.969
	It is necessary to take greater care of your oral hygiene when you are wearing braces	8.58±1.96	8.39±1.68	8.69±2.11	0.466
	People wearing braces are often more bullied than people without braces	8.53±2.05	8.19±2.07	8.72±2.03	0.219
	It is not necessary to visit an orthodontist after the removal of braces	8.12±2.60	7.19±2.83	8.61±2.36	0.008*
	Elastics that should be worn with braces are often not used	7.92±2.35	7.86±2.22	7.96±2.44	0.848
	It is all right to stop treatment if the teeth are straight	7.71±2.39	7.56±2.47	7.79±2.37	0.636
	Orthodontists provide indistinct information	7.15±2.91	6.86±3.09	7.30±2.82	0.469
	Orthodontists often provide reminders	8.25±2.33	7.69±2.45	8.55±2.22	0.074
	Orthodontists spend very little time with their patients	7.37±2.90	6.81±2.81	7.67±2.92	0.14

Independent t-test was used and *p<0.05 was considered statistically significant, SD: Standard deviation

Table 6. Consumption patterns of food groups by gender

Food groups	Consumed n (%)	Not consumed n (%)	Total Mean ± SD	Male Mean ± SD	Female Mean ± SD	p value
Cereal	102 (99)	1 (1)	0.99±0.099	1±0	0.99±0.122	0.466
Vitamin A rich vegetables & tubers	32 (31.1)	71 (68.9)	0.31±0.465	0.25±0.439	0.34±0.478	0.334
White tubers and roots	32 (31.1)	71 (68.9)	0.31±0.465	0.42±0.5	0.25±0.438	0.09*
Dark green leafy vegetables	56 (54.4)	47 (45.6)	0.54±0.501	0.64±0.487	0.49±0.504	0.158
Other vegetables	80 (77.7)	23 (22.3)	0.78±0.418	0.78±0.422	0.78±0.42	0.985
Vitamin A rich fruits	9 (8.7)	94 (91.3)	0.09±0.284	0.08±0.28	0.09±0.288	0.916
Other fruits	39 (37.9)	64 (62.1)	0.38±0.487	0.47±0.506	0.33±0.473	0.154
Organ meat (iron-rich)	1 (1)	102 (99)	0.01±0.099	0	0.01±0.122	0.466
Flesh meats	85 (82.5)	18 (17.5)	0.83±0.382	0.89±0.319	0.79±0.41	0.216
Eggs	64 (62.1)	39 (37.9)	0.62±0.487	0.67±0.478	0.60±0.494	0.911
Fish	52 (50.5)	51 (49.5)	0.50±0.502	0.50±0.507	0.51±0.504	0.163
Legumes, nuts and seeds	45 (43.7)	58 (56.3)	0.44±0.498	0.44±0.504	0.43±0.499	0.911
Milk and milk products	65 (63.1)	38 (36.9)	0.63±0.485	0.72±0.454	0.58±0.497	0.163
Oils and fats	102 (99)	1 (1)	0.99±0.099	0.97±0.167	1	0.174
Sweets	64 (62.1)	39 (37.9)	0.62±0.487	0.67±0.478	0.60±0.494	0.492
Spices, condiments, beverages	102 (99)	1 (1)	0.99±0.099	1	0.99±0.122	0.466

Pearson's correlation test was used and *p<0.05 was considered as statistically significant, SD, standard deviation

females of Chinese ethnicity. They opted for orthodontic treatment to improve their esthetics and were self-motivated. The distribution of patients across the various stages of fixed orthodontics was almost even, with the majority (37.9%) undergoing leveling and alignment, followed by space closure (35.9%) and finishing (26.2%). Most patients perceived dull pain in their teeth for a few hours while eating, but they did not seek any treatment for it. Across all orthodontic procedures, patients perceived the least pain during impression-taking. Even though they perceived most pain from the placement of separators, the pain was rated very low. This may be due to increased pain tolerance levels because the patients were self-motivated to enhance their esthetics. Previous studies by Scheurer et al.³, Sergl et al.⁶, and Bergius et al.²⁴ have reported that orthodontic treatment is generally associated with frequent pain. The present study showed no significant difference in pain perception between sexes, which agrees with the results of Ngan et al.⁵, Bergius et al.²⁵, and Jones and Chan.²⁶ However, there are several other studies^{14,24,27,28} which reported that females perceive more pain than males during fixed orthodontic treatment and are more sensitive to pain, whereas males tolerate pain better. Very few patients consumed medications for pain, a finding supported by previous studies conducted by Jones and Chan²⁶ and Vallerand et al.²⁹ previously. Most patients experienced pain while eating, and many reported that the pain had affected their diet. The impact of pain on diet has been reported previously in the literature.^{10,28}

Orthodontic patients generally have a good level of knowledge, as demonstrated by several studies.^{21,22} In the present study, no correlation was observed between pain perception and patient knowledge. Most patients agreed that "Orthodontic treatment improves esthetics," "Orthodontic treatment corrects teeth and jaw abnormalities," "Incomplete treatment may lead to more problems," "Retainer wear is important after orthodontic treatment," only a few of them disagreed that "Orthodontic treatment duration is long" and "It is important to adhere to food guidelines by orthodontist" which must be explained and reinforced to improve patient expectations and treatment outcomes. Overall, patients in this study had good orthodontic knowledge and perceived low pain levels overall. Abu Alhaja et al.¹⁴ and Touyz and Marchand¹⁵ have reported that dissemination of orthodontic information about expected pain reduces the pain experienced during treatment.

Most patients had a positive attitude toward their orthodontic treatment, as supported by Mendigeri et al.²² Most patients showed a positive attitude overall, the statement "When you wear braces, you need to adjust your dietary habits" scored the lowest, though it still showed a positive attitude. The statement "It is necessary to care more for your oral hygiene when you are wearing braces" scored the highest. There was a significant difference between genders regarding the statement, "It is not required to visit an orthodontist after your braces have been

removed". Females were more likely to visit the dentist after the removal of fixed appliances for follow-up on retention than males. A weak negative correlation between pain perception and attitude was found in accordance with several other studies.^{1,6,14} A positive attitude was observed among patients who experienced less pain during orthodontic treatment.

Most patients experienced pain while eating and reported that their diet was affected. Kausal et al.²⁰ showed that patients have a healthier diet while undergoing treatment, avoiding sticky food like chocolates and snacks, and instead opting for softer food such as porridge and boiled vegetables. However, many patients in this study consumed cereal, dark green leafy vegetables, other vegetables, flesh meat, eggs, fish, milk and milk products, oils, fats, sweets and spices, condiments, and beverages. This indicates that patients are able to maintain a normal diet despite experiencing pain, while adhering to the dietary guidelines recommended by their orthodontist. These factors contribute to the rejection of the hypothesis that patients undergoing fixed orthodontic treatment had a deficient perception of pain, insufficient knowledge, exhibited unfavorable attitudes, and limited dietary diversity.

Nevertheless, there are several food groups that patients did not consume, including Vitamin A-rich vegetables and tubers, white tubers and roots, Vitamin A-rich fruit, other fruits, organ meats, legumes, nuts, and seeds. Ozdemir et al.³⁰ also reported a decline in the intake of vitamins A, C, and E within the first few months of orthodontic treatment among adolescents. Vitamin A, along with calcium and phosphorus, are essential for bone and tooth formation, and their deficiency can retard jaw, teeth, and condylar growth. The reasons for avoidance of these food groups, however, could be multifactorial, such as the patient's food preference, instructions given by the orthodontist, or pain experienced from wearing braces.

Most patients were found to have moderate diet diversity. This suggests that contrary to Singh et al.¹³ patients undergoing orthodontic treatment may not necessarily consume fewer carbohydrates and fiber. However, considering that 6.8% of patients have low diet diversity, dietary interventions by nutritionists could help ensure a more holistic approach to orthodontic treatment. Avoidance of certain food groups and healthy nutritive alternatives could be advised by a nutritionist. It is important that an inter-professional approach to treatment can overcome dietary insufficiencies, thereby improving the patient's overall well-being.³⁰

The present study also investigated the correlation between pain perception and diet diversity among patients undergoing orthodontic treatment. Some studies showed that patients had difficulty in chewing due to the pain experienced after the appliance was bonded or adjusted, and some studies stated that healthier eating habits developed in response to pain and inability to chew.^{19,20} However, no correlation was observed between pain perception and diet diversity among patients undergoing orthodontic treatment in the present study.

Study Limitations

Despite the significant findings, there are several limitations to this study. For instance, it only examined the pain perception, knowledge, attitude, and diet diversity of patients at one time interval in a university clinic. In this pilot study, the complexity of malocclusion was excluded, and the age range was wider. Future research should focus on the individuals' longitudinal changes in pain perception, knowledge, attitude, and diet diversity over time, including more patients with specific malocclusions, at different stages of treatment across smaller age ranges to generalize the results.

CONCLUSION

Pain caused by orthodontic treatment is one of the primary causes that negatively affects an individual's quality of life. In this study, patients who underwent fixed orthodontic treatment had an overall low perception of pain, a good level of orthodontic knowledge, a positive attitude, and moderate diet diversity. Patients who were well informed of the pain and orthodontic procedures prior to treatment reported low levels of pain, thereby strengthening a positive attitude toward their treatment. Pain during treatment can affect dietary intake through restrictions for certain food groups. Hence, to prevent malnutrition during this period of treatment, it is recommended that a nutritionist should work hand in hand with the orthodontist to ensure a holistic approach to treatment. An inter-professional approach along with a nutritionist would benefit such patients without compromising their nutritional well-being due to the pain caused by the treatment.

Ethics

Ethics Committee Approval: This study was approved by the Joint Research and Ethics Committee of the International Medical University [grant no.: BDS I-01/2019(13)].

Informed Consent: Written informed consent was obtained from all patients. For patients aged below 18 years, consent was obtained from the patient and their parents.

Author Contributions: Concept - K.S.; Design - S.M., K.S.; Data Collection and/or Processing - M.E.-V., U.S.B.A.R.; Analysis and/or Interpretation - M.E.-V., U.S.B.A.R., S.M.; Literature Review - M.E.-V., U.S.B.A.R., K.S.; Writing - M.E.-V., K.S.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declare that this study has received no financial support.

REFERENCES

- Kadu A, Chopra SS, Gupta N, Jayan B, Kochar GD. Effects of patient personality traits on pain perception and attitude toward orthodontic treatment. *Journal of Indian Orthodontic Society*. 2015;49(2):89-95. [CrossRef]
- Sergl H. Functional and social discomfort during orthodontic treatment: effects on compliance and prediction of patients' adaptation by personality variables. *Eur J Orthod*. 2000;22(3):307-315. [CrossRef]
- Scheurer P, Firestone A, Bürgin W. Perception of pain as a result of orthodontic treatment with fixed appliances. *Eur J Orthod*. 1996;18(1):349-357. [CrossRef]
- Kvam E, Gjerdet N, Bondevik O. Traumatic ulcers and pain during orthodontic treatment. *Community Dent Oral Epidemiol*. 1987;15(2):104-107. [CrossRef]
- Ngan P, Kess B, Wilson S. Perception of discomfort by patients undergoing orthodontic treatment. *Am J Orthod Dentofacial Orthop*. 1989;96(1):47-53. [CrossRef]
- Sergl H, Klages U, Zentner A. Pain and discomfort during orthodontic treatment: Causative factors and effects on compliance. *Am J Orthod Dentofacial Orthop*. 1998;114(6):684-691. [CrossRef]
- Özkalaycı N, Çiçek O, Ocak Y. Effects of Lingual and Labial Fixed Orthodontic Appliances: A Retrospective Study. *The Journal of Turkish Dental Research*. 2023;2(1):146-153. [CrossRef]
- Haynes S. Discontinuation of orthodontic treatment in the general dental service in England and Wales 1972-1979. *Br Dent J*. 1982;152(4):127-129. [CrossRef]
- Brown D, Moerenhout R. The pain experience and psychological adjustment to orthodontic treatment of preadolescents, adolescents, and adults. *Am J Orthod Dentofacial Orthop*. 1991;100(4):349-356. [CrossRef]
- Chow J, Cioffi I. Pain and orthodontic patient compliance: A clinical perspective. *Seminars in Orthodontics*. 2018;24(2):242-247. [CrossRef]
- Firestone A. Patients' anticipation of pain and pain-related side effects and perception of pain after orthodontic treatment with fixed appliances. *Eur J Orthod*. 1999;21(4):387-396. [CrossRef]
- Mortensen M, Kiyak H, Omnell L. Patient and parent understanding of informed consent in orthodontics. *Am J Orthod Dentofacial Orthop*. 2003;124(5):541-550. [CrossRef]
- Singh J, Dixit P, Singh P, Kedia N, Tiwari M, Kumar A. Pain perception and personality trait toward orthodontic treatment. *J Int Soc Prev Community Dent*. 2017;7(6):377. [CrossRef]
- Abu Alhajja E, AlDaikki A, Al-Omairi M, and Al-Khateeb S. The relationship between personality traits, pain perception, and attitude toward orthodontic treatment. *Angle Orthod*. 2010;80(6):1141-1149. [CrossRef]
- Touyz LZ, Marchand S. The influence of postoperative telephone calls on pain perception: a study of 118 periodontal surgical procedures. *J Orofac Pain*. 1998;12:219-225. [CrossRef]
- En PL, SoYeon O, Nor NN, Mei L, Farella M, Prasad S. Dietary experiences during fixed orthodontic treatment. *APOS Trends Orthod*. 2023;13:60-67. [CrossRef]
- Riordan DJ. Effects of orthodontic treatment on nutrient intake. *Am J Orthod Dentofacial Orthop*. 1997;111:554-561. [CrossRef]
- Heald FP, Gong EJ. Diet, nutrition, and adolescence. In: Shils ME, Olson JA, Shike M, Ross AC, eds. *Modern nutrition in health and disease*. 9th ed. Baltimore, Maryland: Lippincott Williams and Wilkins; 1999:855-867. [CrossRef]
- Singh N, Tripathi T, Rai P, Gupta P. Nutrition and Orthodontics: Interdependence and Interrelationship. *RRJDS*. 2017;5(3):18-22. [CrossRef]
- Kausal S, Agrawal A, Soni UN, Toshniwal NG, Misal A. Pain and discomfort during orthodontic treatment. *IJODR*. 2015;1(1):5-10. [CrossRef]
- Shrestha R, Bhattarai P, Dhakal J, Shrestha S. Knowledge, attitude, and practice of patients toward orthodontic treatment: A multi-center study. *OJN*. 2014;4(1):6-11. [CrossRef]
- Mendigeri V, Thimmaiah UK, Taranaki, Rishad M, Varghese TJ, Chetan GB. Knowledge, attitude, and pain perception about

- orthodontic treatment: a questionnaire survey. *J Int Oral Health*. 2015;7(12):56-60. [\[CrossRef\]](#)
23. Kennedy G, Ballard T, Dop M. Guidelines for measuring household and individual dietary diversity; 2011. Available online: http://www.fao.org/fileadmin/user_upload/wa_workshop/docs/FAO-guidelines-dietary-diversity2011.pdf [\[CrossRef\]](#)
24. Bergius M, Kiliaridis S, Berggren U. Pain in orthodontics. A review and discussion of the literature. *J Orofac Orthop*. 2000; 61(2):125-137. [\[CrossRef\]](#)
25. Bergius M, Broberg A, Hakeberg M, Berggren U. Prediction of prolonged pain experiences during orthodontic treatment. *Am J Orthod Dentofacial Orthop*. 2008;133(3):339.e1-339.e8. [\[CrossRef\]](#)
26. Jones M, Chan C. The pain and discomfort experienced during orthodontic treatment: A randomized controlled clinical trial of two initial aligning arch wires. *Am J Orthod Dentofacial Orthop*. 1992;102(4):373-381. [\[CrossRef\]](#)
27. Krishnan V. Orthodontic pain: from causes to management—a review. *Eur J Orthod*. 2007;29(2):170-179. [\[CrossRef\]](#)
28. Sandhu SS, Sandhu J. Orthodontic pain: an interaction between age and sex in early and middle adolescence. *Angle Orthod*. 2013;83(6):966-972. [\[CrossRef\]](#)
29. Vallerand WP, Vallerand AH, Heft M. The effects of postoperative preparatory information on the clinical course following third molar extraction. *J Oral Maxillofac Surg*. 1994;52(11):1165-1170. [\[CrossRef\]](#)
30. Ozdemir M, Ilhan A, Gorucu-Coskuner H, Taner T, Bilgic P. Assessment of food consumption changes in adolescents during orthodontic treatment. *Am J Orthod Dentofacial Orthop*. 2021;159:604-612. [\[CrossRef\]](#)