

MINI-REVIEW

The effect of orthodontic pain on dental anxiety: a review

Lili Xie^{1,†,*}, Yanan Ma^{2,†}, Xue Sun², Zifan Yu²

¹Department of stomatology, HeBei General Hospital, 050000 Shijiazhuang, Hebei, China

²North China University of Science and Technology, 063000 Tangshan, Hebei, China

***Correspondence**

xielili172398432@outlook.com

(Lili XIE)

† These authors contributed equally.

Abstract

Dental Anxiety constitutes a series of signs of sympathetic hyperfunction that arises during a dental visit. Orthodontic pain is a common reaction in children and adults that can increase dental anxiety and affect orthodontic outcomes. Both malocclusion and orthodontic pain negatively affect quality of life. Dental anxiety and orthodontic pain have different contributing factors, and the prevalence of malocclusion and dental anxiety varies. Different methods have been proposed for the classification of the dental anxiety scales and orthodontic pain as a first approach in the treatment process. The objective of this literature review was to discuss the effect of orthodontic pain on dental anxiety and to explore ways to address dental anxiety in children and adults to reduce negative effects on quality of life. This review not only analyses the prevalence and etiology of dental anxiety, the characteristics and influencing factors of orthodontic pain; but also introduces how dental anxiety and orthodontic pain are diagnosed, and proposes some treatment options. The occurrence of malocclusion has recently risen in children and adults, and the negative effects of orthodontic pain and dental anxiety have been explored in literature. Therefore, this review attempts to provide a critical analysis of dental anxiety and orthodontic pain, to attract the attention of orthodontists and provide a framework for further exploration of effective treatment solutions.

Keywords

Dental anxiety; Orthodontics; Orthodontic pain

1. Introduction

Dental Anxiety (DA), also known as Dental Fear (DF), refers to the unique tension, anxiety and fear of dental treatment, which is a common phenomenon in the patients [1]. Dental anxiety in patients can be accompanied with a variety of nervousness and anxiety [2]. Around 15.3% of patients have varying degrees of dental anxiety, of which 3.3% exhibit severe dental anxiety [3]. Dental anxiety is also extremely common in pediatric dentistry.

The prevalence of malocclusion varies from country to country [4]. The incidence of malocclusion in China was reported at the level of 67.82% [5]. In similar studies, the prevalence of malocclusion in a public school was found to be around 69.1% [6]. In line with The change of diet structure over time and the oral habits have resulted in the increase of maxillofacial deformity in China by Lin Min [7] conducted a systematic review and a meta-analysis of the prevalence of malocclusion in children with dentition in China from 1991 to 2020. The authors reported that nearly half of the children in mainland China had malocclusion, and the prevalence showed a clear upward trend of the occurrence of malocclusion. Shen Lu [8] investigated the prevalence of malocclusion in children aged 14 years. The findings show that nearly 3451 patients exhibited malocclusions in 14-year-old children, corresponding to a prevalence rate of

80.24%. Elyaskhil found that the increase in severity of malocclusion was associated with a negative impact on Oral health-related quality of life (OHRQoL). Females exhibited more severe negative impacts of malocclusions, suggesting a high effect on the psychological behavior of the patients [9]. Studies have confirmed the increase of orthodontic patients have been on the rise [10], and account for about one-third of all outpatients [11]. Therefore, orthodontic patients remain a significant charge to the health system.

The incidence of orthodontic pain has been reported to be 72% to 95% [12, 13]. Studies have shown that about 90% of orthodontic patients' experience pain during treatment [14], 39% of patients feel pain after each medical consultation. Around 8% of orthodontic patients terminate treatment due to the pain associated with consultation and treatment process [15, 16]. Orthodontic pain can also worsen symptoms of dental anxiety. Therefore, the prevention of pain and DA in orthodontic treatment, remains critical to increasing the attendance of patients to clinics.

2. Discussion

2.1 Prevalence and causes of dental anxiety

As early as 1946 [17], Coriatih already believed dental anxiety to be inevitable. There are many epidemiological studies on dental anxiety disorders, and the prevalence trend varies across different countries [18]. Literature shows that the incidence of dental anxiety is higher in patients attending stomatology in China, achieving levels as high as 74.3% [19].

Studies have shown that multiple factors contribute to the occurrence and development of dental anxiety. The latter can be effectively classified in two subsets:

(1) Exogenous factors: Direct factors such as traumatic dental visits [20], fear of some dental operations, the acoustics of teeth-drilling devices or using orthodontic instruments [21], apathy of medical staff during oral treatment [22]. Indirect factors refer mainly to pessimistic information obtained from the friends and family, and negative news or rumors about oral treatments on social media [23].

(2) Endogenous factors are related to personality characteristics. Common internal factors include age, gender, personality traits, temperament types, *etc.* For instance, a neurotic personality can cause trait anxiety in orthodontic [24].

2.2 Characteristics and influencing factors of orthodontic pain

2.2.1 Features of orthodontic pain

The treatment of malocclusion aims at balance, stability and aesthetics, in addition to functional orthodontic elements. After malocclusion, the morphology and function of the dental and maxillofacial areas achieve a new balance and coordination [25]. The occurrence of orthodontic pain may be related to ischemic edema of periodontal ligaments under orthodontic force, as well as the release of chemical mediators and enzymes associated with the inflammatory response [26]. Pain and discomfort after orthodontic intervention are common complications. Pain generally begins relatively within four hours, increases over the next 24 hours, and gradually decreases over seven days an orthodontic intervention [27].

2.2.2 Influencing factors of orthodontic pain

2.2.2.1 Individual factors

Gender: Liu Yan [28] conducted an extensive survey and found that severe pain in orthodontic patients was significantly related to gender. However, there is also a view that gender differences in pain are not significantly. Mazia [29] reported that men felt higher levels of pain than women, both at the beginning of treatments and after 24 hours. On the contrary, Zhang Fubing [30], Eduardo [31] and Abdullah [32] reported that the degree of orthodontic pain was not affected by gender.

Age: In a survey by Liu Yan [28], the findings suggested that severe pain in orthodontic patients was significantly correlated with age. However, other studies suggested that orthodontic pain is independent of age [31].

Dental anxiety: Studies have shown that people with high dental anxiety scores have higher pain scores than those with low dental anxiety scores [33]. Furthermore, the worse the tolerance and tension of patients with dental anxiety to orthodontic treatment, the higher the level of anxiety. Dental

anxiety can reduce pain tolerance. Stimuli of the same intensity do not normally cause a pain response and in anxious patients [34].

2.2.2.2 Orthodontic factors

Appliances: The level of pain experienced by patients varies depending on the appliance used in the treatment method. Self-ligating bracket appliances can reduce the use of ligation wire, reducing mouth sores due to ligation and thus reducing pain [34, 35]. Unlike the constant force of fixed appliances, invisible appliances exert intermittent force on the teeth. Studies have shown that during the first week of orthodontic treatment, patients treated with Clear braces appliances reported lower pain than patients treated with fixed appliances [36, 37].

Material of the initial arch wire: Cioffi *et al.* [38] found that patients using heat-activated nitinol had significantly lower Visual analogue scale (VAS) scores after two to four days following a treatment, compared to those using superelastic nickel-titanium wires. However, Liu Chang *et al.* [39] reported that orthodontic pain was not related to arch wire materials.

2.3 Evaluation methodology

2.3.1 Diagnosis of dental anxiety

The severity of dental anxiety is assessed by means of a representative quantitative questionnaire summarized by psychologists, which is currently commonly used as follows (Table 1):

(1) Dental anxiety scale (DAS)

DAS was first used for evaluation of patients' anxiety levels? A scale for estimating the severity of dental anxiety disorders is established based on a four questions questionnaire, and score varies on a scale of 4–20 points. Patients with 13 points and above are classified as exhibiting dental anxiety. Due to its accuracy and ease of use, it has a wide range clinical applications.

(2) Modified dental anxiety scale (MDAS)

MDAS is a DAS-based scale established in the basis of five questions. It also has a good predictive capability.

(3) A face version of the modified child dental anxiety scale (MCDASf)

MCDASf is a test scale with high confidence level for the assessment of dental anxiety in children. Each question uses a five-level scoring method, which assesses the level of dental anxiety in children through facial expressions such as frowns and smiles.

2.3.2 Assessment of orthodontic pain

Orthodontic pain is the result of a combination of psychology and physiology factors, and objective indicators are difficult to measure its subjective nature [40].

(1) Verbal Rating Scale (VRS)

VRS classifies pain into four levels based on the patient's complaint. This method is relatively easy to understand but has low precision level outcome.

(2) Visual analogue scale (VAS)

VAS is widely used in Chinese clinics, and the approach consists in the use of a swimming ruler about 10 cm long, scaled from 0 to 10, for the assessment of the level of pain

TABLE 1. Commonly used examination methods.

Scale Name	Evaluation Methodology
Dental anxiety scale (DAS)	DAS was first used for evaluation of patients' anxiety levels. A scale for estimating the severity of dental anxiety disorders is established based on a four questions questionnaire, and score varies on a scale of 4–20 points. Patients with 13 points and above are classified as exhibiting dental anxiety. Due to its accuracy and ease of use, it has a wide range clinical applications.
Modified dental anxiety scale (MDAS)	MDAS is a DAS-based scale established in the basis of five questions. It also has a good predictive capability.
A face version of the modified child dental anxiety scale (MCDASf)	MCDASf is a test scale with high confidence level for the assessment of dental anxiety in children. Each question uses a five-level scoring method, which assesses the level of dental anxiety in children through facial expressions such as frowns and smiles.

experienced by the patient. The lowest level of 0 points corresponds to no pain, and 10 points represent the most severe pain considered unbearable.

(3) Numerical Rating Score (NRS)

NRS is a segmented numerical version of VAS that evenly distributes the level of pain on a scale from 0 to 10 on its line segments, requiring participants to circle the corresponding numbers. This score has high reliability and validity and is widely used for the assessment of orthodontic pain in adults.

(4) Health-related quality of life (OHRQOL)

OHRQOL is designed to describe the impact of oral conditions on wider aspects of life; including chewing, pronunciation, oral hygiene, effects on life, work, emotions, interpersonal interactions, *etc.*

2.4 Treatment

Common interventions for dental anxiety include pharmacological interventions, non-pharmacological interventions, or a combination of both treatments.

2.4.1 Pharmacological intervention

Pharmacological intervention refers to direct pain reduction, anxiety relief and behavior through analgesic/sedative drugs, and the effect is faster. However, drug sedation and general anesthesia are affected by the onset time, half-life, dose and side reactions of drugs. There are strict requirements for indications, personnel qualifications, medication safety, *etc.* There is no consensus on effective use at present, and more in-depth clinical discussions are needed [41].

2.4.2 Non-pharmacological treatment

Non-pharmacological treatment is a method of treating a disease without taking medication.

2.4.2.1 Behavioral induction techniques

The medical staff can reduce patients' stress through step-by-step experience and progressively decrease children's anxiety and tension through enquiring patients' knowledge about their feared treatments or diagnosis approaches [42].

2.4.2.2 Lecture-show-do method

This approach consists in explaining the overall process followed by demonstration of the operation before the actual intervention. The lecture-show-do method is widely used by medical practitioners today as a pre-treatment behavior management guideline [43].

2.4.2.3 Distraction

There are many ways to help orthodontists distract patients from the procedure. The recent increase in the awareness of the use of virtual reality, particular in the gaming industry, has resulted in a wider application of the technology, even in the medical sector [44]. Virtual reality technology has been used to treat dental anxiety in dentistry through distraction [45]. The results of cell phone analysis by López-Valverde *et al.* [46] show that virtual reality technology is an effective distraction method to reduce pain and anxiety in patients undergoing various dental treatments.

2.4.2.4 Behavioral cognition

Cognitive behavioral therapy is a psychotherapy method used under the guidance of cognitive behavioral theory to change poor cognition by changing the patient's thinking and behavior [47]. Treating dental anxiety requires overcoming inappropriate perceptions and expectations and rebuilding the patients' perception of dental treatment to address anxiety issues [1].

2.4.2.5 Improve patient trust

Studies have shown [48] that the patient-dentist relationship has a significant impact on dental anxiety development levels. The importance of building a trustworthy doctor-patient relationship is of considerable significance. This can be achieved through effective communication strategies, the establishment of positive relationship to gain the patients confidence. Explanations provided beforehand, allowing for the patient's consent, and continued communication throughout the intervention can relax and eliminate the patient's tension.

3. Conclusion

Dental Anxiety not only affects people's motivation to seek treatments for orthodontic diseases, but also affects the treatment's effect and can even worsen the doctor-patient relation-

ship. With the continued improvement of the quality of life and medical level across the globe, people's mental health and medical environment have attracted more attention and need to be considered in the overall orthodontic interventions. Therefore, dental practitioners should learn to diagnose dental phobia patients in time and immediately intervene accordingly. This can effectively reduce the occurrence of dental anxiety, which has important clinical significance for dental patients.

AVAILABILITY OF DATA AND MATERIALS

Not applicable.

AUTHOR CONTRIBUTIONS

LLX—designed the research study. XS—performed the research. ZFY—data collection. YNM—wrote the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

ACKNOWLEDGMENT

Not applicable.

FUNDING

This research received no external funding.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

- [1] ZHANG Shunhao, WANG Yuxuan, LI Mingli. Research progress on psychotherapy for dental anxiety. *Journal of Prevention and Treatment for Stomatological Diseases*. 2022; 30: 680–684.
- [2] QIN Qing, CHANG Tiantian, SONG Yang, Li Qiang, Chen Yongjin. Review on dental fear therapy methods. *Progress in Modern Biomedicine*. 2016; 16: 3190–3195.
- [3] Silveira ER, Cademartori MG, Schuch HS, Armfield JA, Demarco FF. Estimated prevalence of dental fear in adults: a systematic review and meta-analysis. *Journal of Dentistry*. 2021; 108: 103632.
- [4] Alhammadi M S, Halboub E, Fayed M S, Labib A, El-Saaiddi C. Global distribution of malocclusion traits: a systematic review. *Dental Press Journal of Orthodontics*. 2018; 23: 40.e1–40.e10.
- [5] FU Minkui, ZHANG Ding, WANG Bangkang, DENG Yan, Wang F, Ye X. The prevalence of malocclusion in China—an investigation of 25392 children. *Chinese Journal of Stomatology*. 2002; 37: 371–373.
- [6] Fadel M, Santos B Z, Antoniazzi R P, Koerich L, Bosco VL, Locks A. Prevalence of malocclusion in public school students in the mixed dentition phase and its association with early loss of deciduous teeth. *Dental Press Journal of Orthodontics*. 2022; 27: e2220120.
- [7] LIN Min. Prevalence of malocclusion in mixed-dentition in Chinese school children, 1991–2020: a systematic review and meta-analysis [master's thesis]. Chongqing Medical University. 2020.
- [8] SHEN Lu. Prevalence of malocclusion in 3–14-year-old children in Chongqing, China: a cross-sectional study [master's thesis]. Chongqing Medical University. 2018.
- [9] Elyashkil M, Shafai NAA, Mokhtar N. Effect of malocclusion severity on oral health related quality of life in Malay adolescents. *Health and Quality of Life Outcomes*. 2021; 19: 71.
- [10] PANG Lan, YANG Siwei. Research progress on psychological factors in the adult orthodontic treatment. *International Journal of Stomatology*. 2010; 37: 116–119.
- [11] CHEN Yangxi. Orthodontics in adults. *Chinese Journal of Stomatology*. 2004; 22–23.
- [12] Kavaliauskiene A, Smailiene D, Buskiene I, Keriene D. Pain and discomfort perception among patients undergoing orthodontic treatment: results from one month follow-up study. *Stomatologija*. 2012; 14: 118–125.
- [13] Koritsánszky N, Madléna M. Pain and discomfort in orthodontic treatments. Literature review. *Fogorvosi Szemle*. 2011; 104: 117–121. (In Hungarian)
- [14] Asiry M A, Albarakati S F, Al-Marwan M S, Al-Shammari RR. Perception of pain and discomfort from elastomeric separators in Saudi adolescents. *Saudi Medical Journal*. 2014; 35: 504–507.
- [15] Lew KK. Attitudes and perceptions of adults towards orthodontic treatment in an Asian community. *Community Dentistry and Oral Epidemiology*. 1993; 21: 31–35.
- [16] Patel V. Non-completion of active orthodontic treatment. *British Journal of Orthodontics*. 1992; 19: 47–54.
- [17] Sternbach A. Dental anxiety: fear of going to the dentist. *American Journal of Psychotherapy*. 1947; 1: 239–241.
- [18] ZHANG Yun, ZHONG Changping, PENG Yanhua, Dong Tianzhen, Zhang Ni, Wu Yinxia, *et al*. Research progress on dental anxiety. *Journal of Modern Medicine & Health*. 2014; 30: 2612–2614. (In Chinese)
- [19] WANG Yan, QI Wanhua, SHAN, Lianqi, Zhang Feng, Yao Fangyuan, Wang Yanyu. Influencing factors of dental anxiety in oral clinic patients. *China Journal of Health Psychology*. 2014; 22: 25–26.
- [20] Karibe H, Koeda M, Aoyagi-Naka K, Kato Y, Tateno A, Suzuki H, *et al*. Differences in the perception of dental sounds: a preliminary study. *Patient Preference and Adherence*. 2019; 13: 1051–1056.
- [21] Alenezi A, Aldokhayel H. The impact of dental fear on the dental attendance behaviors: a retrospective study. *Journal of Family Medicine and Primary Care*. 2022; 11: 6444.
- [22] Jaakkola S, Lahti S, Rähä H, Saarinen M, Tolvanen M, Aromaa M, *et al*. Dental fear affects adolescent perception of interaction with dental staff. *European Journal of Oral Sciences*. 2014; 122: 339–345.
- [23] Ogawa M, Harano N, Ono K, Shigeyama-Tada Y, Hamasaki T, Watanabe S. Association between sensory processing and dental fear among female undergraduates in Japan. *Acta Odontologica Scandinavica*. 2019; 77: 525–533.
- [24] HUANG Yufei, XIAO Danna. Psychological characteristic of periodontal disease on orthodontic patients: the moderating effect of personality on the anxiety. *Journal of Tianjin Medical University*. 2022; 28: 314–317. (In Chinese)
- [25] FU Minkui. Orthodontics. People's Medical Publishing House: Beijing. 2000.
- [26] Long H, Wang Y, Jian F, Liao L, Yang X, Lai W. Current advances in orthodontic pain. *International Journal of Oral Science*. 2016; 8: 67–75.
- [27] Hussain AS, Al Toubity MJ, Elias WY. Methodologies in orthodontic pain management: a review. *The Open Dentistry Journal*. 2017; 11: 492–497.
- [28] LIU Yan, LUO Wei, LIU Haixia. Clinical factors analysis of pain degree in orthodontic patients. *Journal of Shantou University*. 2016; 31: 75–80.
- [29] Jawaid M, Qadeer T A, Fahim M F. Pain perception of orthodontic treatment—a cross-sectional study. *Pakistan Journal of Medical Sciences*. 2020; 36: 160–165.
- [30] ZHANG Fubing. A comparative study of pain and discomfort in orthodontic patients with self-ligating orthodontic appliance and clear aligner [Master's thesis]. Hubei Medical College. 2022.
- [31] Costa E, Blagitz M N, Normando D. Impact of catastrophizing on pain during orthodontic treatment. *Dental Press Journal of Orthodontics*. 2020; 25: 64–69.
- [32] Aldrees A. Intensity of pain due to separators in adolescent orthodontic patients. *Journal of Orthodontic Science*. 2015; 4: 118.
- [33] FAN Xiaoping. Study on influence of dental anxiety on patients'

- experience during orthodontic treatment [master's thesis]. Chongqing Medical University. 2005.
- [34] SHEN Yuxin, ZHANG Jinglu, CHEN Wenjing. Research progress of orthodontic pain. *Journal of Stomatology*. 2015; 35: 412–416.
- [35] Fleming PS, DiBiase AT, Sarri G, Lee RT. Pain experience during initial alignment with a self-ligating and a conventional fixed orthodontic appliance system. *The Angle Orthodontist*. 2009; 79: 46–50.
- [36] Almasoud N N. Pain perception among patients treated with passive self-ligating fixed appliances and Invisalign® aligners during the first week of orthodontic treatment. *Korean Journal of Orthodontics*. 2018; 48: 326–332.
- [37] Diddige R, Negi G, Kiran K, Chitra P. Comparison of pain levels in patients treated with 3 different orthodontic appliances—a randomized trial. *Medicine and Pharmacy Reports*. 2020; 93: 81–88.
- [38] Cioffi I, Piccolo A, Tagliaferri R, Paduano S, Galeotti A, Martina R. Pain perception following first orthodontic archwire placement—thermoelastic vs. superelastic alloys: a randomized controlled trial. *Quintessence International*. 2012; 43: 61–69.
- [39] Liu C, Wang Y, Pan W L, Yu CH, Huang JY, Hua CG. Relationship between initial archwire materials and pain at the initial stage of orthodontic treatment: a systematic review and network meta-analysis. *West China Journal of Stomatology*. 2018; 36: 296–300. (In Chinese)
- [40] Gu Ming, Xu Hui. Influencing factors and evaluation methods of orthodontic pain. *Beijing Journal of Stomatology*. 2022; 30: 222–224.
- [41] WANG Chunli, LI Hua, LI Xiu'e. Research status and progress of dental anxiety. *Chinese Journal of Modern Nursing*. 2020; 26: 2965–2970.
- [42] WANG Chunyan. Application study on the role of behavior management in dental anxiety among preschool children with decay [master's thesis]. Shandong University. 2019.
- [43] WANG Lixin. Comparison of the role of speaking-showing-doing and imitation in alleviating dental anxiety in children. *Journal of Clinical Medical Literature*. 2017; 24: 4582.
- [44] LI Jing. Application and progress of music therapy in dental anxiety. *Modern Practical Medicine*. 2017; 08: 1118–1120.
- [45] Warm. Research on the effect of virtual reality technology on psychological intervention of adult orthodontic pain [master's thesis]. Kunming Medical University. 2020.
- [46] López-Valverde N, Muriel-Fernández J, López-Valverde A, Valero-Juan LF, Ramírez JM, Flores-Fraile J, *et al.* Use of virtual reality for the management of anxiety and pain in dental treatments: systematic review and meta-analysis. *Journal of Clinical Medicine*. 2020; 9: 3086.
- [47] TIAN Song Qingmeng. Effectiveness of cognitive behavioral therapy in reducing dental anxiety in preschool children [Master's thesis]. Shanxi Medical University. 2020.
- [48] Kheir OO, Ziada HM, Abubakr NH, Abdel-Rahman ME, Fadl SM, Ibrahim YE. Patient—dentist relationship and dental anxiety among young Sudanese adult patients. *International Dental Journal*. 2019; 69: 35–43.

How to cite this article: Lili XIE, Yanan MA, Xue SUN, Zifan YU. The effect of orthodontic pain on dental anxiety: a review. *Journal of Clinical Pediatric Dentistry*. 2023; 47(5): 32-36. doi: 10.22514/jocpd.2023.051.