https://umedpress.com
Annals of Medical, Nursing, and Dental-aligned Research
Vol 1, Issue 1, 2025

Evaluation of impact of orthodontic treatment in psychology of pediatric patients: An original research

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Abstract

Background: Orthodontic treatment is commonly sought for correcting dental malocclusions and improving facial aesthetics. However, emerging research suggests that orthodontic intervention may also have broader physiological and psychological benefits, particularly among pediatric patients.

Objective: This study aimed to investigate the physiological wellness outcomes of orthodontic treatment among pediatric patients attending schools, with a focus on heart rate variability (HRV), stress levels, self-esteem, and social anxiety.

Methods: A longitudinal study was conducted at a tertiary care center specializing in orthodontic treatment. A total of 300 pediatric patients, aged 8 to 16 years, undergoing orthodontic treatment were recruited for participation. Physiological parameters, including HRV and salivary cortisol levels, were assessed at baseline and follow-up visits. Self-esteem and social anxiety levels were evaluated using standardized questionnaires. Qualitative interviews were conducted to explore subjective experiences and perceptions of orthodontic treatment among participants.

Results: Quantitative analysis revealed significant improvements in HRV, with an increase in parasympathetic activity post-treatment ($p < 0.05$). Salivary cortisol levels and self-reported stress scores exhibited significant reductions following orthodontic treatment ($p < 0.01$). Self-esteem scores significantly improved post-treatment ($p < 0.001$), indicating enhanced self-perception and confidence among pediatric patients. Similarly, social anxiety levels significantly decreased post-treatment ($p < 0.001$), reflecting improved social functioning and interpersonal relationships. Qualitative analysis identified themes of increased confidence, improved social interactions, and enhanced overall well-being among pediatric patients following orthodontic intervention.

Conclusion: Orthodontic treatment exerts significant physiological and psychological benefits on pediatric patients, encompassing improvements in HRV, stress levels, self-esteem, and social anxiety. These findings highlight the importance of considering the holistic impact of orthodontic intervention on pediatric well-being and underscore the need for comprehensive pediatric healthcare approaches that integrate dental, physiological, and psychological considerations.

Keywords: orthodontic treatment, pediatric patients, physiological wellness, school settings, mixed-methods approach

Introduction

Orthodontic treatment has long been recognized for its ability to correct dental malocclusions and improve facial aesthetics [1]. This field of dentistry has witnessed significant advancements in techniques and technologies aimed at enhancing treatment outcomes and patient experience [2]. While the primary focus of orthodontic intervention remains on achieving functional occlusion and esthetic harmony, emerging research suggests that its impact extends beyond the realm of dentistry, encompassing broader physiological and psychological benefits [3].

Historically, orthodontic treatment was predominantly viewed as a cosmetic procedure, sought primarily for aesthetic enhancement [4]. However, the evolving understanding of craniofacial biology and biomechanics has shed light on the intricate interplay between dental occlusion, musculoskeletal function, and overall health [5]. This paradigm shift has prompted a reevaluation of the therapeutic potential of orthodontics, prompting researchers and clinicians to explore its effects on various aspects of physiological wellness.

The physiological wellness of individuals encompasses a range of factors, including cardiovascular health, neuroendocrine regulation, and psychosocial well-being [6]. Orthodontic treatment has been postulated to influence these physiological parameters through its effects on craniofacial morphology, masticatory function, and temporomandibular joint dynamics [7]. For instance, the correction of dental malocclusions can alleviate excessive occlusal forces, thereby reducing the risk of temporomandibular joint disorders and associated musculoskeletal pain [8]. Furthermore, orthodontic intervention may improve respiratory function by optimizing airway dimensions and reducing obstruction secondary to malocclusion [9].

Beyond its physiological effects, orthodontic treatment has been linked to improvements in psychological well-being and quality of life [10]. Adolescence, a period characterized by significant physical and psychosocial changes, often coincides with the need for orthodontic care [11]. Dental malocclusions can impact self-esteem, social interactions, and overall satisfaction with appearance, particularly during this vulnerable developmental stage [12]. Orthodontic treatment has been shown to alleviate psychosocial distress, enhance self-image, and improve social functioning among adolescent patients [13].

Despite these potential benefits, there remains a paucity of research examining the physiological wellness outcomes of orthodontic treatment, particularly among pediatric populations within school environments. Schools serve as important settings for assessing the impact of orthodontic intervention on children's health and well-being, given the significant amount of time spent in these environments and the potential influence of peer interactions and academic performance on psychosocial outcomes [14].

This study aims to address this gap in the literature by investigating the physiological wellness effects of orthodontic treatment among pediatric patients attending schools. By employing a mixed-methods approach that combines quantitative assessments of physiological parameters with qualitative exploration of patient experiences, this research seeks to provide a comprehensive understanding of the multifaceted benefits of orthodontic intervention. Understanding the physiological mechanisms underlying the effects of orthodontic treatment can inform clinical decision-making, enhance treatment outcomes, and ultimately improve the overall health and well-being of pediatric populations.

Materials and Methods

This longitudinal study was conducted at a tertiary care center specializing in orthodontic treatment. The study received ethical approval from the Institutional Review Board (IRB) prior to commencement. A total of 300 pediatric patients, aged 8 to 16 years, undergoing

orthodontic treatment at the center were recruited for participation in the study. Informed consent was obtained from the parents or legal guardians of all participants prior to their inclusion in the study.

The inclusion criteria for participation in the study were as follows: pediatric patients undergoing comprehensive orthodontic treatment for dental malocclusions, including fixed or removable appliances, and willing to comply with the study protocols. Patients with systemic illnesses or craniofacial syndromes that could potentially affect the outcomes of orthodontic treatment were excluded from the study.

The sample size was determined based on power analysis, considering the anticipated effect size and the desired level of statistical power. A sample size of 300 pediatric patients was deemed sufficient to detect statistically significant changes in physiological parameters with a power of 80% and a significance level of 0.05.

Data collection was conducted at multiple time points throughout the course of orthodontic treatment, including baseline (prior to treatment initiation) and follow-up visits at 3-month intervals. Physiological parameters were assessed using standardized measurement tools and techniques. Heart rate variability (HRV), a widely accepted marker of autonomic nervous system activity, was measured using a heart rate monitor. Stress levels were evaluated through salivary cortisol assays and self-reported stress questionnaires administered to the participants.

In addition to quantitative assessments, qualitative data were obtained through semi-structured interviews with a subset of participants to explore their subjective experiences and perceptions of orthodontic treatment. Interviews were conducted by trained researchers in a confidential setting and audio-recorded for subsequent transcription and analysis.

Statistical analysis was performed using appropriate parametric and non-parametric tests, depending on the distribution of the data. Changes in physiological parameters over time were analyzed using repeated measures ANOVA or Friedman tests, with post-hoc comparisons conducted using Bonferroni or Dunn's tests, respectively. Qualitative data from interviews were analyzed thematically to identify recurrent themes and patterns in participants' narratives.

Results

Table 1: Changes in Heart Rate Variability (HRV) Before and After Orthodontic Treatment

The table presents the alterations in heart rate variability (HRV) observed in pediatric patients before and after orthodontic treatment. HRV is an indicator of the autonomic nervous system's activity, with higher HRV reflecting increased parasympathetic tone and better physiological adaptability. The baseline HRV measurement indicates a mean value of 50.2 milliseconds (ms) with a standard deviation of 12.3 ms. Following orthodontic treatment, the mean HRV significantly increased to 65.8 ms, accompanied by a reduced standard deviation of 9.7 ms ($p < 0.05$). This finding suggests a notable enhancement in parasympathetic activity post-treatment, indicative of improved autonomic regulation and reduced physiological stress levels among pediatric patients undergoing orthodontic intervention.

Table 2: Changes in Stress Levels Before and After Orthodontic Treatment

The table presents the alterations in stress levels observed in pediatric patients before and after orthodontic treatment, as assessed through salivary cortisol assays and self-reported stress scores. Baseline measurements indicate an average salivary cortisol level of 0.8 nanograms per milliliter (ng/ml) and a self-reported stress score of 7.2 on a scale of 1 to 10. Following orthodontic treatment, both salivary cortisol levels and self-reported stress scores exhibited significant reductions, with post-treatment values of 0.5 ng/ml and 4.1, respectively ($p < 0.01$). These findings suggest a substantial decrease in physiological and subjective

stress levels among pediatric patients following orthodontic intervention, indicating a positive impact on psychological well-being.

Table 3: Changes in Self-Esteem Scores Before and After Orthodontic Treatment

The table presents the changes in self-esteem scores reported by pediatric patients before and after orthodontic treatment. Baseline assessment reveals a mean self-esteem score of 5.8 on a scale of 1 to 10, indicative of moderate self-esteem levels. Following orthodontic treatment, there was a significant improvement in self-esteem, with the mean score increasing to 7.4 ($p < 0.001$). This finding suggests that orthodontic intervention positively influenced the self-perception and confidence of pediatric patients, leading to enhanced self-esteem levels and a more positive self-image.

Table 4: Changes in Social Anxiety Levels Before and After Orthodontic Treatment

The table presents the alterations in social anxiety levels reported by pediatric patients before and after orthodontic treatment. Baseline assessment reveals a mean social anxiety score of 6.5 on a scale of 1 to 10, indicating moderate levels of social anxiety. Following orthodontic treatment, there was a significant reduction in social anxiety levels, with the mean score decreasing to 3.2 ($p < 0.001$). This finding suggests that orthodontic intervention contributed to a significant alleviation of social anxiety symptoms among pediatric patients, leading to increased comfort and confidence in social interactions.

Table 5: Themes Identified from Qualitative Interviews

The table presents the themes identified from qualitative interviews conducted with pediatric patients undergoing orthodontic treatment. Common themes included increased confidence, improved social interactions, and enhanced overall well-being following orthodontic intervention. Participants reported feeling better about themselves, experiencing less self-consciousness when smiling or talking to others, and noticing improvements in their daily lives. These qualitative findings complement the quantitative data, providing subjective insights into the holistic benefits of orthodontic treatment on the psychological well-being and quality of life of pediatric patients.

Table 1: Changes in Heart Rate Variability (HRV) Before and After Orthodontic Treatment

Time Point	Mean HRV (ms)	Standard Deviation (ms)	p-value
Baseline	50.2	12.3	
Post-treatment	65.8	9.7	< 0.05

Table 2: Changes in Stress Levels Before and After Orthodontic Treatment

Parameter	Baseline Level	Post-treatment Level	p-value
Salivary Cortisol (ng/ml)	0.8	0.5	< 0.01
Self-reported Stress Score (1-10)	7.2	4.1	< 0.01

Table 3: Changes in Self-Esteem Scores Before and After Orthodontic Treatment

Time Point	Mean Self-Esteem Score (1-10)	Standard Deviation	p-value
Baseline	5.8	1.2	
Post-treatment	7.4	1.0	< 0.001

Table 4: Changes in Social Anxiety Levels Before and After Orthodontic Treatment

Time Point	Mean Social Anxiety Score (1-10)	Standard Deviation	p-value
Baseline	6.5	1.5	
Post-treatment	3.2	1.0	< 0.001

Table 5: Themes Identified from Qualitative Interviews

Theme	Representative Quote
Increased Confidence	"I feel much better about myself now that my teeth are straight."
Improved Social Interactions	"I'm not as self-conscious when I smile or talk to people anymore."
Enhanced Overall Well-being	"Orthodontic treatment has made a big difference in how I feel every day."

Discussion

Orthodontic treatment has traditionally been focused on correcting dental malocclusions and enhancing facial aesthetics [1]. However, the findings of this study underscore the broader physiological and psychological benefits of orthodontic intervention among pediatric patients. The discussion will explore the implications of the study's results in the context of physiological wellness, psychological well-being, and the holistic approach to pediatric healthcare.

Physiological Wellness Outcomes: The significant improvements in heart rate variability (HRV) observed among pediatric patients following orthodontic treatment indicate a favorable impact on autonomic nervous system activity and physiological adaptability. HRV reflects the balance between sympathetic and parasympathetic nervous system activity, with higher HRV associated with better cardiovascular health and stress resilience [2]. The increase in HRV post-treatment suggests enhanced parasympathetic tone and reduced physiological stress levels among pediatric patients, indicative of improved autonomic regulation and overall well-being.

Similarly, the reduction in salivary cortisol levels and self-reported stress scores following orthodontic treatment highlights the positive effects on the neuroendocrine stress response. Cortisol is a key hormone involved in the body's stress response, and elevated levels have been linked to various adverse health outcomes, including cardiovascular disease, metabolic disorders, and mental health disorders [3]. The observed decrease in cortisol levels post-treatment suggests a downregulation of the stress response system, leading to reduced physiological stress and improved health outcomes among pediatric patients undergoing orthodontic intervention.

Psychological Well-being Outcomes: Orthodontic treatment has long been recognized for its potential to enhance psychological well-being and quality of life by addressing aesthetic concerns and improving self-image [4]. The findings of this study further corroborate these assertions, with significant improvements observed in self-esteem and social anxiety levels among pediatric patients following orthodontic treatment. The increase in self-esteem scores reflects the positive impact of orthodontic intervention on self-perception, confidence, and body image satisfaction among pediatric patients. Adolescence is a critical period for the development of self-esteem and identity, and dental malocclusions can significantly impact adolescents' self-image and social interactions [5]. Orthodontic treatment provides an opportunity to address these concerns, leading to increased self-esteem and improved psychosocial functioning among pediatric patients.

Likewise, the reduction in social anxiety levels post-treatment signifies the positive effects of orthodontic intervention on social functioning and interpersonal relationships. Social anxiety is a common psychological condition characterized by fear and avoidance of social situations, often stemming from concerns about one's appearance or perceived social judgment [6]. Dental malocclusions can exacerbate social anxiety symptoms by contributing to self-consciousness and negative self-perception [7]. Orthodontic treatment addresses these underlying concerns, leading to improved social confidence and reduced social anxiety among pediatric patients.

Holistic Approach to Pediatric Healthcare: The findings of this study underscore the importance of adopting a holistic approach to pediatric healthcare that considers the interplay between dental, physiological, and psychological factors in promoting overall well-being. Orthodontic treatment represents more than just a dental intervention; it serves as a gateway to improving physiological wellness, psychological resilience, and quality of life among pediatric populations. By addressing dental malocclusions and associated physiological and psychological sequelae, orthodontic intervention contributes to the comprehensive care of pediatric patients, encompassing both physical and mental health domains.

Furthermore, the integration of qualitative insights from patient interviews enhances our understanding of the subjective experiences and perceptions of orthodontic treatment among pediatric patients. Qualitative data provide valuable context to complement quantitative findings, offering nuanced insights into the psychosocial impact of orthodontic intervention on patients' lives. The themes identified from qualitative interviews, such as increased confidence and improved social interactions, resonate with the quantitative improvements observed in self-esteem and social anxiety levels, further reinforcing the holistic benefits of orthodontic treatment on pediatric well-being.

Implications for Clinical Practice: The findings of this study have several implications for clinical practice and the delivery of orthodontic care to pediatric patients. First and foremost, orthodontists should recognize the multifaceted nature of orthodontic treatment and its potential to influence physiological wellness and psychological well-being beyond dental correction. Clinicians should consider incorporating objective measures of physiological wellness, such as HRV monitoring and stress biomarker assessment, into routine orthodontic evaluations to assess treatment outcomes comprehensively.

Additionally, clinicians should prioritize patient-centered care and actively engage pediatric patients in treatment decision-making processes. By acknowledging and addressing patients' concerns, fears, and expectations, orthodontists can enhance treatment adherence, satisfaction, and outcomes. Moreover, orthodontic practices should strive to create a supportive and empathetic environment that fosters open communication and trust between patients and providers, facilitating positive treatment experiences and outcomes.

Future Directions: While this study provides valuable insights into the physiological and psychological benefits of orthodontic treatment among pediatric patients, several avenues for future research warrant exploration. Longitudinal studies with extended follow-up periods are needed to assess the sustainability of treatment effects on physiological wellness and psychological well-being over time. Additionally, comparative studies examining the efficacy of different orthodontic treatment modalities and techniques in improving physiological and psychological outcomes would provide valuable insights into optimal treatment approaches.

Furthermore, research investigating the potential mechanisms underlying the observed improvements in physiological and psychological parameters following orthodontic treatment is warranted. Understanding the physiological pathways and neurobiological mechanisms through which orthodontic intervention influences autonomic nervous system activity, stress regulation, and psychosocial functioning can inform targeted interventions and personalized treatment approaches tailored to individual patient needs.

Conclusion

In conclusion, orthodontic treatment exerts significant physiological and psychological benefits on pediatric patients, encompassing improvements in heart rate variability, stress levels, self-esteem, and social anxiety. These findings underscore the importance of considering the holistic impact of orthodontic intervention on pediatric well-being and highlight the need for a comprehensive approach to pediatric healthcare that integrates dental, physiological, and psychological considerations. By addressing the multifaceted needs of

pediatric patients, orthodontic treatment plays a pivotal role in promoting physiological wellness, psychological resilience, and overall quality of life among pediatric populations.

References

1. Proffit WR, Fields HW Jr, Sarver DM. Contemporary Orthodontics. 6th ed. St. Louis, MO: Elsevier Mosby; 2019.
2. Krishnan V, Davidovitch Z. Cellular, molecular, and tissue-level reactions to orthodontic force. Am J Orthod Dentofacial Orthop. 2006;129(4):469.e1-32.
3. Fleming PS, DiBiase AT, Sarver DM, Lee RT. Orthodontic treatment of the Class II non-compliant patient: current principles and techniques. J Orthod. 2015;42(Suppl 1):S30-S43.
4. Shaw WC, Richmond S, O'Brien KD. The use of occlusal indices: a European perspective. Am J Orthod Dentofacial Orthop. 1995;107(1):1-10.
5. Bishara SE. Textbook of Orthodontics. Philadelphia, PA: Saunders; 2001.
6. Thayer JF, Lane RD. The role of vagal function in the risk for cardiovascular disease and mortality. Biol Psychol. 2007;74(2):224-242.
7. Al-Fraidi AA, Zafar MS. Impact of orthodontic treatment on periodontal health: a review. J Pak Med Assoc. 2018;68(12):1850-1854.
8. Miyamoto K, Morita Y, Nohno K, et al. Relationship between malocclusion and temporomandibular disorders in young adults: a systematic review of population-based studies. J Oral Rehabil. 2018;45(3):250-257.
9. Guilleminault C, Huang YS, Monteyrol PJ, et al. Critical role of myofascial reeducation in pediatric sleep-disordered breathing. Sleep Med. 2013;14(6):518-525.
10. Shaw WC, Richmond S, O'Brien KD. The use of occlusal indices: a European perspective. Am J Orthod Dentofacial Orthop. 1995;107(1):1-10.
11. Beaton L, Freeman R, Humphris G, et al. Why are people afraid of the dentist? Observations and explanations. Med Princ Pract. 2014;23(4):295-301.
12. Locker D. Disparities in oral health-related quality of life in a population of Canadian children. Community Dent Oral Epidemiol. 2007;35(5):348-356.
13. Zhang M, McGrath C, Hagg U. The impact of malocclusion and its treatment on quality of life: a literature review. Int J Paediatr Dent. 2006;16(6):381-387.
14. Slade GD, Spencer AJ. Development and evaluation of the Oral Health Impact Profile. Community Dent Health. 1994;11(1):3-11.