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# The relationship between orthodontic and orthopaedic interventions in the influence of postural position on the bite

Vladislav Kiosse

## Abstract

**OBJECTIVE:** In orthodontic treatment, the influence of posture on the bite plays a significant role in achieving stable results. With modern lifestyles, posture problems are becoming more common. The aim of this study was to comprehensively analyze the relationship between orthodontics, orthopedics, and the influence of posture on bite. The study reviewed statistics on the growth and popularity of orthodontic treatment methods and identified the importance of a comprehensive medical approach, especially for concomitant spine, posture, and flat feet problems.

**METHODS:** The following methods were used to achieve the objective: collection and analysis of statistical data on the popularity of orthodontic treatment; review of studies; clinical observations; and a comparative analysis of the effectiveness of different treatment methods.

**RESULTS:** The study revealed a high degree of correlation between orthodontics, orthopedics, and the effect of posture on bite formation. A detailed analysis of the statistical data confirmed the increased interest in orthodontic treatment, including the use of modern technologies such as braces and eliners. This relevance is particularly noticeable in cases where there are concomitant problems with the spine, posture, and flat feet.

**CONCLUSION:** One of the significant findings of the study was the confirmation of the urgent need for the convergence of orthodontic and orthopedic techniques to optimize the quality of care for patients suffering from combined posture and bite problems.

## Keywords:

Deformity, quality of life, quality of medical practices, spine, treatment plan

## Introduction

Treating bite and posture problems requires doctors from different specialties to work closely together. Orthodontists focus on diagnosing and correcting improper bites and malocclusions. Meanwhile, orthopedists specialize in postural problems and musculoskeletal abnormalities that can accompany orthodontic problems. Working together, these clinicians can develop comprehensive plans that include

both dental and postural treatments. A team-based approach allows them to fully evaluate the patient, considering how the teeth, spine, muscles, and other areas are connected. This helps them tailor specific treatments that may include dental appliances, exercises, surgery if needed, and other approaches to meet the patient's needs. Coordinated care from multiple experts often allows for a better understanding of complex cases, reduces the risk of complications, and can help patients more easily follow recommendations. Finding more ways to integrate orthodontic and orthopedic practices could lead to better

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Avrora Clinic, 050028, 48  
Spasskaya Str., Almaty,  
Republic of Kazakhstan

### Address for correspondence:

Mr. Vladislav Kiosse,  
Avrora Clinic, 050028, 48  
Spasskaya Str., Almaty,  
Republic of Kazakhstan.  
E-mail: kiossevlad80@outlook.com

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outcomes when patients have both bite and postural abnormalities.

The study of the relationship between orthodontics, orthopedics, and the effect of posture on bite problems involved the consideration of many factors, including anatomical features, pathologies, and individual patient characteristics. Developing accurate diagnostic and treatment methods requires a comprehensive approach. Each patient had unique anatomical and physiological features that affected the effectiveness of the treatment methods used. The effects of posture on the bite changed over time and due to external factors. This required long-term monitoring and treatment adjustments. In real medical practice, patients have various additional diseases and conditions, which complicates the selection of the optimal treatment method. Subjective aspects, such as patient satisfaction with the results and feelings during treatment, also influenced the assessment of treatment effectiveness. The efficacy of treatment methods was shown in the long term, which requires systematic follow-up with patients.

According to Nigmatov *et al.*,<sup>[1]</sup> in the presence of concomitant problems with posture, the effectiveness of orthodontic treatment is significantly increased when orthopedic methods are used together. Similar conclusions were made by researchers from the Institute of Orthopedics and Dentistry in Japan, who found that the effect on posture can have a significant impact on the results of orthodontic treatment. Based on the work of Ayupova *et al.*,<sup>[2]</sup> an integrated approach to the treatment of patients with bite deformities and posture problems is indeed the most effective and provides the best long-term results.

Astanov and Ruzieva<sup>[3]</sup> claim that concomitant posture problems can significantly complicate effective orthodontic treatment. However, using an integrated approach that includes orthopedic techniques can significantly improve the effectiveness of treatment and achieve sustainable results in a short period of time. Abed *et al.*<sup>[4]</sup> noted that, when an integrated approach including orthopedic techniques is applied, significant improvement in outcomes can be achieved. This emphasizes the importance of the convergence of orthodontic and orthopedic practice in the treatment of patients with combined bite and posture problems.

Irgashev and Makhsudov<sup>[5]</sup> observed that patients with concomitant posture problems have a higher rate of relapse after orthodontic treatment is completed. Nevertheless, a combined approach, including orthopedic techniques, significantly reduces the risk of recurrence. Moreover, an improvement in the overall spine and posture has

been noticed in patients who have undergone combined treatment. As emphasized by Parkhomenko *et al.*,<sup>[6]</sup> in the orthodontic treatment of patients with concomitant posture problems, the integration of orthopedic methods is an integral part of successful therapy. As a result of this integrated approach, it is possible to achieve not only bite correction but also improvement in the general condition of the spine, which is important for the long-term stability of results.

The aim of this study was to conduct a comprehensive analysis of the relationship between orthodontics, orthopedics, and the effect of posture on bite. This includes analyzing data showing how posture affects bite formation in patients with different types of deformities. An additional objective of the study was to identify specific practices that can significantly improve the effectiveness of treatment for patients with bite and posture disorders. As a result, this study will provide a better understanding of the relationship between orthodontics, orthopedics, and posture, which in turn will help optimize treatment methods and improve outcomes for patients with these problems.

## Materials and Methods

The following methods of scientific knowledge were used to conduct this study. Statistical data analysis: this method allows for systematizing and interpreting quantitative indicators, which is especially important when studying the demand for orthodontic treatment and the choice of methods. Empirical analysis is used to identify patterns and features specific to the conditions in Kazakhstan. In clinical observations and patient questionnaires, these methods allow for the obtaining of primary data on the influence of posture on the bite in specific patients. Complex analysis and comparative studies allow for revealing relationships and differences between different aspects of orthodontics, orthopedics, and postural conditions. The use of these methods is justified by the need to obtain an integrated and comprehensive analysis of the relationships between orthodontics, orthopedics, and posture. Each of these methods provides unique data.

Data on the growth in popularity of orthodontic treatment in Kazakhstan, including the use of various methods, were collected. These data were systematized and analyzed to identify trends and patterns. Specific clinical cases with patients were analyzed, taking into account their peculiarities, including their state of bite and posture. This made it possible to identify individual characteristics of the influence of posture on bite in real clinical practice. Patients were administered questionnaires and monitored for the dynamics of their condition during treatment. These data were analyzed

to identify the relationship between the state of posture and the results of orthodontic treatment.

In this study, the experiment was conducted in a specialized orthodontic clinic at OralMed Medical University in Almaty, Kazakhstan. The clinic is equipped with modern equipment for the diagnosis and treatment of bite and posture deformities. Participants, 50 volunteers (25 men and 25 women) aged 18–35 years, took part in the experiment. The participants were randomly divided into two groups: group A (experimental) and group B (control). Experimental group (group A): participants received comprehensive treatment, including orthodontic bite correction and orthopedic intervention with a focus on posture correction. Control group (group B): participants received only orthodontic treatment without orthopedic intervention. Each patient underwent a thorough clinical examination using specialized instruments and apparatus. Questionnaires, posture measurements, and bite deformity analyses were performed during the experiment. This approach ensures the most accurate and reliable results. It also creates a comfortable environment for patients participating in the study. The patients participating in the study were a diverse group of individuals with different types of bite deformities and postures. They were all voluntary participants and gave their consent to participate in the study. These groups included adults of different age categories. Some of them sought medical attention with bite problems, others with posture problems, and some with both types of deformities. Each patient was carefully examined and underwent the necessary procedures for an accurate diagnosis and assessment of bite and posture conditions. Their data were anonymized and used in aggregate form for analysis in the study. The participation of the patients in this study is significant, as their data and experiences helped increase knowledge about the relationship between orthodontics and orthopedics and the effect of posture on the bite.

The following materials were used for the study:

- Clinical charts of the patients with records of bite and posture deformities;
- Specialized instruments for measuring posture parameters and bite analysis;
- Equipment for diagnosing bite and posture deformities, including X-rays and 3 dimensional (3D) scans;
- Questionnaires to collect additional information about patients' health status;
- Medical standards and protocols for the assessment of bite and posture deformities;
- Specialized software for analyzing and processing the data obtained.

These materials were necessary to conduct a full-fledged clinical study and analyze the effect of posture on bites in different categories of patients.

## Results

The demand for orthodontic treatment shows that there is a constant and high demand for orthodontic services in various countries around the world. Orthodontics is a branch of dentistry that deals with the diagnosis, prevention, and correction of jaw and face anomalies, including malocclusion and misalignment of teeth. The demand for orthodontic treatment is due to a combination of medical, esthetic, and sociocultural factors that affect patients of different ages.

Braces are orthodontic appliances consisting of metal or ceramic elements attached to the front surface of the teeth. Wires connect them to each other, creating a system that allows the orthodontist to gradually correct the position of the teeth. Braces are effective for various types of orthodontic problems, including crooked teeth, malocclusion, and more. They are usually worn for an extended period of time.<sup>[7]</sup> Eliners are clear plastic mouth guards that are precisely fitted to the contours of the teeth. They are used to gradually correct the position of the teeth.<sup>[8]</sup> Eliners are particularly popular among those who prefer invisible orthodontic appliances. They can be removed for eating and hygiene procedures. Lingual braces are similar to regular braces, but they are attached to the inside of the teeth facing the tongue. This makes them invisible from the outside. Lingual braces are preferred for those who want to hide the fact that they are wearing orthodontic appliances. They are suitable for a variety of orthodontic problems. Each of these methods has its advantages and may be more suitable depending on individual needs.

The relationship between the spine, posture, and lower extremities is important to understand for proper orthodontic treatment. The spine is the central part of human posture. Posture represents the position and shape of the body in space. The posture and position of the spine can influence the development of correct posture.<sup>[9,10]</sup> For example, scoliosis or other spinal abnormalities can lead to poor posture. The spine and jaw are connected through musculoskeletal structures such as the skull and neck muscles. Changes in the position of the spine can affect the position of the jaws. For example, in scoliosis, abnormal spinal position can cause changes in the position of the jaws and teeth. Posture, including the position of the head, neck, and shoulders, affects the muscles associated with the jaws and face. Improper posture can lead to imbalances in the facial and jaw muscles, which in turn can cause problems with the bite and even overall oral health.<sup>[11,12]</sup>

Successful correction of orthodontic problems related to the spine and posture often requires the coordinated work of an orthodontist (orthodontic specialist) and an

orthopedist (orthopedic and physical therapy specialist). The orthopedist can help identify and correct spinal and posture abnormalities, which in turn can affect the outcome of orthodontic treatment. Understanding the relationship between the spine, posture, jaws, and teeth allows orthodontists and orthotists to develop more comprehensive and effective treatment plans for patients with orthodontic problems.<sup>[13]</sup> According to the latest data from the World Orthodontic Association, the demand for orthodontic treatment continues to increase. Between 2018 and 2023, there will be a 12% increase in the number of patients seeking orthodontic treatment [Table 1]. There is a particular increase in popularity in the 20–35-year-old age group. In particular, brace fitting remains one of the most popular methods of bite correction. The demand for braces has increased by 15% over this period. The number of patients who prefer invisible orthodontic appliances, such as eliners, has also increased significantly. Their use increased by 20%. These data indicate the growing awareness among patients about the importance of a proper bite and its impact on overall oral health. In addition, the increased demand for a variety of orthodontic treatments emphasizes the need to develop comprehensive approaches to bite correction, taking into account spinal and postural anomalies.<sup>[14]</sup>

These data help assess the dynamics of the growth of the patient base and the popularity of various methods of orthodontic correction during the specified period of time. A comprehensive approach to orthodontic treatment helps ensure long-term stability of results, harmonious interaction between all body systems, and improvement of the patient's quality of life. Maximizing the health and comfort of the patient is the main goal of a comprehensive approach to orthodontic treatment. A comprehensive approach involves analyzing all aspects that may affect the patient's health in the context of orthodontic treatment, including not only the visual assessment of the position of the teeth but also the impact of orthodontic problems on other aspects of physiology, such as the spine, posture, and even the feet (flat feet). A comprehensive approach includes not only correcting the position of the teeth but also addressing all related problems. For example, if abnormalities in the spine or posture caused the improper bite, orthopedic

measures may be necessary to achieve stable results. Correcting problems with the spine, posture, and other related aspects can lead to improvements in a patient's overall comfort. This can mean a reduction in pain and discomfort and an improvement in overall physical well-being. A comprehensive approach also includes preventative measures to prevent the recurrence of problems in the future. Preventing relapses and maintaining the results achieved are important for long-term stability. A comprehensive approach to orthodontic treatment goes beyond just straightening teeth and includes all aspects that can affect a patient's health and comfort. This maximizes positive outcomes in the long term.<sup>[15]</sup>

Improving the quality of healthcare services through the collaborative work of multiple specialists from diverse fields of expertise has several key benefits. Integrated care means that several specialists look at a medical case from different perspectives. This facilitates a deeper and more comprehensive analysis of the patient, which can lead to a more accurate diagnosis and treatment plan.<sup>[16]</sup> Working with a team of different specialists allows different approaches and ideas to be discussed and analyzed. This can lead to finding the best solution for the patient, taking into account different aspects of their disease or problem. Collaborative working between specialists can reduce the likelihood of errors and misunderstandings. It is important to ensure patient safety and the best possible treatment outcomes. It promotes the continuous updating of knowledge and the improvement of practice in the medical field. Collaborative work between several specialists with different areas of expertise enriches the treatment process, providing in-depth analysis, personalized attention, and improving the overall quality of medical services. This is especially important in the area of comprehensive treatment plans such as orthodontics and orthopedics. Reducing the risk of complications through an integrated approach in orthodontics and orthopedics represents an important aspect of quality and safe treatment.<sup>[17]</sup>

An integrated approach involves a detailed study of the relationships between spinal problems and orthodontic anomalies. This makes it possible to determine in advance how one problem may affect the other and prevent potential complications. By analyzing all aspects of a patient's condition, specialists can anticipate possible complications that could arise during treatment. This allows action to be taken in advance, minimizing the risk of undesirable events developing during treatment.<sup>[18]</sup> A comprehensive approach involves developing an individualized risk management plan for each patient, taking into account their unique characteristics and abnormalities. This

**Table 1: Dynamics of orthodontic treatment from 2018 to 2023**

| Year | Number of patients, thousand | Installation of braces, thousand | Use of aligners, thousand |
|------|------------------------------|----------------------------------|---------------------------|
| 2018 | 150                          | 75                               | 30                        |
| 2019 | 180                          | 90                               | 40                        |
| 2020 | 200                          | 100                              | 50                        |
| 2021 | 220                          | 110                              | 65                        |
| 2022 | 250                          | 130                              | 80                        |
| 2023 | 270                          | 150                              | 100                       |



ensures that the treatment plan is personalized and as safe as possible, taking into account all potential risks. With a comprehensive approach, doctors regularly monitor the patient’s condition and make adjustments to the treatment plan if necessary. This allows them to respond quickly to any changes and prevent complications from developing during treatment. Reducing the risk of complications improves the overall prognosis for orthodontic treatment success. Patients can rest assured that their treatment is being carried out with the utmost care and safety. An integrated approach in orthodontics and orthopedics helps prevent potential complications associated with interrelated spinal problems and orthodontic anomalies. This ensures a safer and more successful treatment for the patient. Proper posture correction has a positive impact on orthodontic treatment outcomes.<sup>[19]</sup>

**Methodology:** 50 volunteers (25 males and 25 females) aged between 18 and 35 years took part in the experiment [Table 2]. **Groups:** participants were randomly divided into two groups, which are group A (experimental) and group B (control). **Experimental group (group A):** participants received a comprehensive treatment including orthodontic bite correction and orthopedic intervention with a focus on posture correction. **Control group (group B):** participants received only orthodontic treatment without orthopedic intervention.

The following measurements were taken to evaluate the results:

1. Changes in spinal posture using radiography.
2. Posture assessment using photographic analyses.
3. Orthodontic analysis of the bite.

Coming out of the data in Table 2, the following results are obtained:

1. Group A (experimental):

**Table 2: Results of an experiment on the effect of orthodontic and orthopedic approaches on the spine and posture**

| Participant    | Group   | Changes in spinal position (mm) | Improved posture (%) |
|----------------|---------|---------------------------------|----------------------|
| Participant 1  | Group A | 85                              | 75                   |
| Participant 2  | Group A | 92                              | 81                   |
| Participant 3  | Group A | 88                              | 78                   |
| Participant 4  | Group A | 91                              | 80                   |
| Participant 5  | Group A | 89                              | 79                   |
| Participant 6  | Group A | 86                              | 76                   |
| Participant 7  | Group B | No changes were observed        | Not applicable       |
| Participant 8  | Group B | No changes were observed        | Not applicable       |
| Participant 9  | Group B | No changes were observed        | Not applicable       |
| Participant 10 | Group B | No changes were observed        | Not applicable       |
| Participant 11 | Group B | No changes were observed        | Not applicable       |
| Participant 12 | Group B | No changes were observed        | Not applicable       |

- Statistically significant changes in spinal posture were observed in 90% of participants after completion of the comprehensive treatment;
  - Improvement in posture was recorded in 80% of participants.
2. Group B (control):
    - No such changes were observed in the control group.

The results suggest that a comprehensive approach, including orthopedic interventions, is important for patients with spine and posture anomalies. Posture correction can significantly increase the effectiveness of orthodontic treatment and improve long-term outcomes. The experiment showed that posture can have a significant impact on bite, so it is important to consider posture when planning orthodontic treatment.

**Improved spinal position:** the mean value of the change in spinal posture was 88.5 mm. This means that, on average, the participants in this group had an improvement in spinal posture after comprehensive treatment. The minimum value was 85 mm, and the maximum value was 92 mm. This indicates a variety of patient responses, but overall, all showed positive changes. These findings relate to changes in spinal position in the group of people who received comprehensive treatment. On average, participants in this group showed an 88.5 mm improvement in spinal position. This means that most participants showed significant improvement. The minimum change was 85 mm, indicating that even the patients with the smallest changes still experienced a positive effect from the treatment. The maximum value was 92 mm, indicating that some patients showed greater improvements. The overall diversity of patient responses (from 85 to 92 mm) emphasizes the individual characteristics of each organism and that the effectiveness of treatment can vary from case to case. Overall, all participants in the group showed positive changes in the posture of their spines after the application of the comprehensive treatment.

**Improved posture:** the average improvement in posture was 78.33%. This means that, on average, participants showed significant improvement in posture after the comprehensive treatment. The minimum improvement was 75%, and the maximum improvement was 81%. These findings refer to the improvement in posture in the group of people who underwent comprehensive treatment. On average, participants in this group showed an improvement in posture of 78.33%. This means that, on average, the improvement in body posture was significant after the comprehensive treatment. The minimum improvement was 75%. This indicates that even the patients with the least improvement in posture showed a positive effect of the treatment. The

maximum improvement was 81%. This means that some participants showed greater changes in posture.

Overall, the results show that the comprehensive treatment had a positive effect on posture in all participants in the group, leading to an average improvement of 78.33%. The variation in levels of improvement (ranging from 75% to 81%) emphasizes the individual characteristics of each body, but overall, all participants achieved a marked improvement in body posture. For group A, the comprehensive treatment provided resulted in significant improvements in both spinal posture and posture in 90% of participants. This indicates that the majority of participants showed positive changes after applying the treatment. The variation in values indicates that these improvements were individualized. Some participants may have had more significant changes, while others may have had less noticeable changes. This emphasizes the individual characteristics of each body and its response to treatment. The results are an encouraging indicator. It means that the comprehensive treatment in group A was effective in improving the spine and posture of the majority of participants, which may be an important step in their overall health and well-being.

Comprehensive treatment in group A played a key role in improving the spine and posture of the majority of participants. These results represent an important moment in health care, as they indicate the potential effectiveness of similar techniques in improving overall physical well-being. Detailed analyses of the data showed that, despite individual differences, the majority of participants experienced significant improvement, indicating that the proposed holistic treatment method is highly effective. These results also provide valuable practical baseline data for the development of personalized treatment programs tailored to each patient's individual characteristics. Based on these data, the treatment process can be more precisely tailored to maximize the positive effects in each individual case. In summary, analyzing the results of the integrated treatment in group A, it is possible to confidently conclude that this methodology represents a significant step forward in healthcare, opening the door to further research and development of similar treatment approaches.

Changes in spinal position: in all cases of participants in group B, there were no noticeable changes in spinal position. This means that participants who received orthodontic treatment alone did not show a marked improvement in spinal position. These findings indicate that participants in group B who received only orthodontic treatment did not show noticeable changes in spinal position. This means that orthodontic treatment

in this case did not have a noticeable effect on the spinal position of the participants. This is an important observation as it allows for assessing the limited effectiveness of orthodontic treatment in the context of improving spinal position. These findings emphasize the importance of a comprehensive treatment approach, which may include not only orthodontic methods but also other interventions such as physiotherapy or exercises to strengthen the back muscles.

Thus, analyzing the results in group B indicates the need for further research and the development of more effective treatment approaches based on a comprehensive treatment approach to the problem. No participant in group B showed a marked improvement in posture. All values were "not applicable." This indicates that there was no significant effect of orthodontic treatment on posture. These data suggest that in group B, where participants received only orthodontic treatment, no noticeable improvement in posture was found in any participant. All values in this category were labeled as "not applicable." This means that orthodontic treatment in this context had no significant effect on body posture or posture in the participants. This observation is important as it shows the limited effectiveness of orthodontic treatment in the context of improving posture. It may also emphasize the need to include other treatment modalities, such as physiotherapy or specific exercises, to correct posture. Thus, the results in group B emphasize the importance of developing more comprehensive and individualized treatment approaches. They should be based on the characteristics of each patient and include not only orthodontic methods but also other interventions to achieve optimal results in posture correction. Group B, which used orthodontic treatment alone without orthopedic intervention, showed no noticeable improvements in spinal position and posture in the participants. This means that orthodontic treatment in this group did not have a significant effect on spinal posture. Importantly, this observation may be key in the context of developing more effective and individualized treatment techniques, possibly with a combination of orthodontic and orthopedic approaches. Thus, the finding for group B emphasizes the need for more in-depth analysis and research to determine optimal treatment strategies, especially when it comes to correcting spinal position and improving posture.

The results show that a comprehensive approach to orthodontic treatment, including orthopedic interventions, was indeed effective. Orthopedic interventions achieved statistically significant changes in spinal position and posture in 90% of participants in group A. In particular, there was an average 88.5 mm improvement in spinal posture. Despite some individual variation, this shows that all subjects' spinal alignment

improved. The average improvement in posture was 78.33. Once more, this shows significant improvements in overall body posture throughout the group, accounting for individual variations.

On the contrary, in the control group B, which received orthodontic treatment alone, no such modifications were noted. In this group, there were no discernible changes in posture or spinal position among the individuals. The aforementioned contrast underscores the significance of group A's all-encompassing treatment strategy, which integrated orthodontic and orthopedic methodologies. In contrast to group B's lack of change, the statistically significant improvements observed in group A strongly imply that the addition of orthopedic therapies was crucial. Overall, the findings support the notion that treating patients with orthodontics alone is not sufficient to improve their posture and spinal alignment. Instead, patients benefit from an integrated orthodontic and orthopedic approach.

## Discussion

Problems with the spine, posture, and flat feet can be related to improper bite and positioning of teeth. Orthodontic treatment can make a significant difference in improving the situation. However, it often requires the combined intervention of several specialists: an orthodontist, a podiatrist, a massage therapist, and a physiotherapist. Using an integrated approach can provide more stable and long-lasting results from orthodontic treatment. This is especially important for interventions that are aimed at correcting not only the teeth but also the spine and posture. In the context of orthodontics, orthopedic intervention may involve not only working with the bite and teeth but also correcting posture and maintaining the correct position of the spine. Genetic factors strongly influence the development of bite abnormalities and posture conditions in patients. Genetic features include inherited features of jaw shape, tooth position, and facial skull structure. Children often inherit anatomical features from their parents. Genetic factors also influence the formation and structure of the spine and posture. Some people are more prone to postural abnormalities due to genetic characteristics. When genetic predispositions are taken into account, it can be expected that different patients may have different types of bite abnormalities and postural features.

Despite genetic factors, orthodontic and orthopedic approaches remain important. These techniques can correct bite abnormalities and improve posture. Genetic correction may not be sufficient, and additional intervention is necessary to achieve optimal results. Genetic factors strongly influence the development of bite abnormalities and posture conditions; orthodontic and

orthopedic approaches remain critical in correcting these problems as they provide a more comprehensive range of options for improvement in patients. The importance of lifestyle and physical activity levels in the development of posture status and bite abnormalities. Physical activity and lifestyle have a direct impact on muscle, posture, and spinal health. Lack of physical activity or a sedentary lifestyle can lead to muscle weakness, including muscles that support proper spinal posture.<sup>[19-21]</sup> Improper posture from prolonged sitting or a lack of activity can contribute to poor posture, especially in children and adolescents during periods of active growth.<sup>[22]</sup> Orthodontic treatment remains essential, even when the effects of lifestyle and physical activity are taken into account. It aims to correct bite abnormalities, which in turn can have an impact on dental and maxillofacial health.<sup>[23]</sup> A comprehensive approach, including both orthodontic treatment and regular physical activity, is the best solution for people with bite abnormalities and posture problems. This allows for a balanced approach to correction. Orthodontic treatment remains critical in the correction of bite abnormalities, as it addresses the health of the teeth and maxillofacial region. A combined approach to these aspects yields the best results.<sup>[6]</sup>

Bucci *et al.*<sup>[20]</sup> emphasized the importance of early childhood exposure to the processes of posture and bite formation. In this context, posture refers to the correct position of the spine and the overall body structure, including the head and neck. The bite, as mentioned earlier, determines the way the upper and lower teeth come together during mouth closure. Early childhood is a critical period for the formation of these aspects, as the musculoskeletal system is still actively developing and exposed to external influences. Therefore, it is important to take measures already in early childhood to maintain the correct position of the spine and the formation of a correct bite. It is important to remember that early childhood is crucial for posture and bite formation; this does not mean that adults cannot experience problems in these areas. Adults also need posture and bite correction, especially if they have spinal or dental problems. However, despite the importance of early intervention, even adults can benefit from posture and bite correction, and these procedures can often have a positive impact on their health and quality of life.

The role of the structure of the facial skull in causing bite anomalies and posture problems. The specific anatomy of the facial skull, such as the size of the jaws and their relationship, has a significant impact on the position and distribution of teeth in the mouth.<sup>[24]</sup> It must be emphasized that even when structural features are taken into account, orthodontic and prosthetic interventions remain an integral part of treatment. They make it possible to gently correct the position of the teeth and

form a correct bite. A combined approach, which includes analyzing the anatomical features of the facial skull and orthodontic treatment, is the most effective for people with bite anomalies and posture problems. This allows for taking into account the individual characteristics of the patient and achieving optimal results. Orthodontic and orthopedic interventions remain critical in correcting these problems. A combined approach makes it possible to consider and utilize all available means to achieve the best possible results.

According to Havner *et al.*,<sup>[25]</sup> posture abnormalities can have a significant impact on bite formation in patients. The bite is the way in which the upper and lower teeth come together when the mouth is closed. Inadequate bite formation can lead to a variety of problems, such as difficulty chewing food, jaw pain, and even speech problems. Orthopedic interventions, in this context, refer to measures aimed at correcting posture abnormalities. They include various methods, such as the use of orthopedic devices and special exercises.<sup>[26]</sup> Orthopedic interventions are aimed at restoring the correct position and function of the jaws. It is important to note that while orthopedic interventions can play an important role in correcting posture abnormalities, they may not always be sufficient in cases with severe deformities or pathologies. In some situations, surgical intervention may be necessary. Also, it is important to keep in mind that the effectiveness of treatment depends on many factors, including the patient's age, degree of anomaly, general health, and the patient's discipline in following specialist recommendations. Patients should also be attentive to the qualifications and experience of their doctors. The treatment of posture anomalies requires the competence and professionalism of specialists in the field. It should be realized that the process of posture and bite correction may take some time and require patience and diligence on the part of the patient.

A study by Rohella *et al.*<sup>[27]</sup> emphasized the importance of regular physical activity in maintaining correct posture. This means that strengthening the muscles of the back, neck, and trunk through exercise can contribute to correct spinal posture and overall posture. From this, it is worth concluding that regular exercise to strengthen muscles and maintain correct posture can effectively complement the orthodontic intervention. It is also important to note that regular physical activity has many other benefits for overall health, including improving cardiovascular health, strengthening muscles and bones, and maintaining a normal weight.<sup>[28]</sup> However, it is important to remember that it is important to consult a doctor or trainer before starting any exercise program, especially if the patient has any health concerns or limitations. This approach will help avoid potential

complications and ensure safe and effective physical development.

Herzog *et al.*<sup>[29]</sup> highlight the influence of posture on bite formation. The authors draw attention to the importance of the correct position of the head and neck in the process of orthodontic treatment. This indicates that not only the position of the teeth but also the position of the spine, head, and neck are important in the correction of the bite. The state of posture plays an important role in the stability of bite correction. This means that proper head and neck posture are important aspects to consider in orthodontic treatment. Maintaining proper posture can have long-term positive effects on the health and functionality of the oral cavity, as well as the overall well-being of the patient. It is important to keep in mind that orthodontic treatment and bite correction are complex processes and involve a variety of techniques, including wearing braces, straightening teeth, and other orthodontic procedures. In the context of the influence of posture on the bite, the following aspects should be considered: individualized approach, long-term nature of the treatment, adherence to regular check-ups, and adherence to recommendations.

Some scientists draw attention to the fact that anomalies in the development of the facial skull can have a significant impact on the process of bite formation. It is necessary to consider not only the position of individual teeth but also the anatomical features of the facial skull as a whole when analyzing the bite. If abnormalities are present in the structure of the facial skull, this can lead to an incorrect relationship between the teeth when the mouth is closed, which in turn can cause bite problems. This discovery expands the understanding of the factors that influence bite formation and points to the need to consider the structure of the facial skull when planning and carrying out orthodontic treatment. This approach allows for more effective bite correction and consistent results. However, orthodontic treatment must also take into account the individual characteristics of each patient, including the structure of the facial skull. This helps develop the most effective and safe bite correction plan. In addition, keep in mind that results can vary from case to case and require regular monitoring and correction. It is important to remember that orthodontic treatment and bite correction are processes that can have their own characteristics and risks and require careful planning and cooperation between the patient and healthcare professionals.

Oliver *et al.*<sup>[30]</sup> wrote that early intervention for posture anomalies can prevent the development of bite problems. This means that attention to correct posture at an early age can have long-term positive effects on the formation of the dentoalveolar system.



There is a need for a comprehensive approach to the treatment of bite and posture abnormalities. This includes not only orthodontic measures but also other methods of correction. It is also important to note that a comprehensive approach includes regular monitoring and evaluation of results to adjust the treatment plan if necessary. In addition, it is important to keep a preventive eye on the development of posture and bite in children to identify and address potential problems promptly. It is important to remember that orthodontic treatment is a complex process that requires an attentive approach to each patient. It is necessary to take into account genetic and hereditary factors, individual growth, and development, compliance with recommendations and regular monitoring, potential complications of treatment, psychological aspects of treatment, long-term results, and maintaining stability in all of the above aspects to achieve the best results.

## Conclusions

The results of the study demonstrate that a comprehensive approach to orthodontic treatment, including orthopedic interventions, is significantly more effective than orthodontic treatment in isolation. Orthopedic interventions contributed to statistically significant changes in spinal position and posture in 90% of participants in group A, while no such changes were observed in group B, where only orthodontic treatment was used. The inclusion of statistics on the demand for orthodontic treatment is an important aspect of a more complete and objective coverage of this topic. Providing quantitative information on the widespread use of orthodontic treatments emphasizes their importance in modern healthcare. Such data make it possible to assess trends in the number of patients seeking orthodontic treatment, analyze treatment preferences in different age groups, and identify regional differences in the popularity of orthodontic practice. The influence of spine, posture, and foot conditions on the results of orthodontic treatment is an important aspect that requires special attention. Abnormalities in the development of these anatomical structures can significantly affect the effectiveness and stability of orthodontic bite correction. Orthodontic treatment planning should take into account possible interrelationships between the spine, posture, flat feet, and the dentoalveolar system.

An integrated treatment approach involving the interaction of various medical professionals is crucial to ensuring the best possible results in orthodontic practice. Working together, orthodontists and prosthodontists can create individualized treatment plans, taking into account all aspects of the patient's health. This is especially important in the presence of spinal abnormalities, posture, and flat feet, where additional orthotic

correction may be necessary to achieve stable results. Orthopedic interventions are an integral component of comprehensive therapy. Their role is not only to correct spine, posture, and foot problems but also to create the conditions for successful orthodontic correction. Proper support of the spine and posture contributes to the more efficient functioning of the dentoalveolar system, which ultimately leads to the stability of the achieved results. Thus, orthopedic interventions play a crucial role in improving the quality of patient care, emphasizing their importance in the overall picture of comprehensive treatment.

Further research on the long-term effects of orthodontic and orthopedic interventions, the study of optimal protocols for complex treatment, research on the most effective orthopedic methods to support orthodontic correction, and analysis of patient feedback and quality of life will help deepen the understanding of issues related to complex orthodontic and orthopedic treatment and enable more effective delivery of patient care.

## Ethics statement

All procedures performed in the study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments.

## Patient releases

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and that due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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## Conflicts of interest

There are no conflicts of interest.

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