INTERDISCIPLINARY APPROACH TO ORTHODONTIC TREATMENT INVOLVING AN OSTEOPATH AND A DENTIST (PROTOCOL)

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Contemporary approaches to orthodontic treatment are complex: in complicated cases, they combine removable/fixed orthodontic appliances and surgical treatment, i.e., extraction of permanent teeth. In order to prevent negative outcomes and complications that can follow correction of dentofacial abnormalities and deformities, children and adults alike need to be thoroughly examined and prepared to the orthodontic stage of treatment. Many studies point to the relationship between orthodontic treatment and development of somatic dysfunctions. The purpose of this work was to develop an osteopathic disorders correction algorithm that can be introduced to an interdisciplinary protocol uniting efforts by an osteopath and an orthodontist with the aim to improve the quality of specialized orthodontic medical care.

Keywords: orthodontic treatment, osteopathic correction, somatic dysfunction, interdisciplinary interaction

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Compliance with ethical standards: the study was approved by the Ethics Committee of the Research Centre for Medical Genetics (protocol № 4/2 dated 19 April 2021). The patients submitted the informed consent to participation in scientific research.

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ПРОТОКОЛ МЕЖДИСЦИПЛИНАРНОГО ВЗАИМОДЕЙСТВИЯ ОСТЕОПАТА И СТОМАТОЛОГА В ПРОЦЕССЕ ОРТОДОНТИЧЕСКОГО ЛЕЧЕНИЯ

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Современное ортодонтическое лечение носит комплексный характер и включает не только использование съемных и несъемных ортодонтических конструкций, но и оперативное лечение (экстракцию постоянных зубов) в сложных случаях. Необходимы тщательное обследование и подготовка пациентов перед ортодонтическим этапом лечения для профилактики отрицательных результатов и осложнениий коррекции зубочелюстных аномалий и деформаций, как у детей, так и у взрослых. Результаты многих исследований указывают на взаимосвязь между ортодонтическим лечением и формированием соматических дисфункций. Целью работы было разработать алгоритм коррекции остеопатических нарушений, который может быть внедрен в практику междисциплинарного взаимодействия врача-остеопата и стоматолога-ортодонта для повышения качества специализированной ортодонтической медицинской помощи.

Ключевые слова: ортодонтическое лечение, остеопатическая коррекция, соматическая дисфункция, междисциплинарное взаимодействие

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According to the literature, dentofacial abnormalities registered in the population of the Russian Federation are highly variable. Most researchers believe that prevalence of such abnormalities grows with age and ranges from 30 to 80% [1–3]. In complicated cases, contemporary orthodontic treatment protocols combine removable/fixed orthodontic appliances and surgery.

As previous studies indicate, extraction of individual teeth can help establish multiple stable contacts between dental arches and normalize functionality of the dentofacial system. The teeth pulled most often in the context of orthodontic treatment, including protocols that employ braces, are third molars, followed by first molars [4–6]. A complex therapy of dentofacial abnormalities may justifiably imply cooperation of dentists specializing in related fields [7], with the goals of such therapy being normalization of occlusion, restoration of the dentofacial system's functions, and aesthetic reconstruction.

From the point of view of osteopathic diagnosis, a dominant somatic dysfunction in the human body can stem from specific somatic dysfunctions, namely, their intraocclusive variations, which are directly related to the anatomical features conditioning occlusion. The dominant somatic dysfunctions developing in such a case are disorders of venous return from the head, vestibulopathies, disorders of the temporomandibular joint. This, in turn, affects the patient's quality of life [3, 6–9]. Therefore, it is important for an orthodontist to professionally cooperate not only with fellow dentists, but also with medical doctors specializing in other fields, including osteopaths [8–12].

Previous studies have shown that osteopathic correction added to dental and orthodontic treatment significantly reduces the frequency and severity of somatic dysfunctions of head and neck, thus significantly improving the quality of life of patients [13–17]. There is no single protocol of interdisciplinary interaction involving an osteopath and an orthodontist described in the literature. Moreover, no paper presents an intraocclusive somatic dysfunctions remedying algorithm, which may include, firstly, curing compression as the cause of disorders of the peripheral nervous system and vascular hydrodynamic disorders, and secondly, remediation of hypercapnia, a marker of impaired venous circulation and hypoxia, which signals arterial circulation disruptions [18].

This study aimed to develop an interdisciplinary cooperation algorithm involving a dentist and an osteopath in the context of preparing a patient for specialized dental treatment and subsequent comprehensive rehabilitation seeking to mitigate the risk of complications manifesting as tension headaches.

METHODS

The study analyzed the data from outpatient records of 340 patients who applied to the clinic in 2014 through 2023, with an established tension headaches diagnosis (ICD G44.2) being the inclusion requirement. Among the clinical symptoms, patients mentioned moderate pain, generalized, more often of a squeezing, compressive nature, episodic or chronic. As a rule, headache originated in the occipital or frontal part of the head, and spread further to all parts thereof. The participants were divided into two groups, 170 patients in each.

Treatment group inclusion criteria: application to the osteopathic clinic during ongoing orthodontic treatment that began 1–3 months before that application; complaints of cephalgia, cervicalgia.

Control group inclusion criteria: complaints of cephalgia, cervicalgia; no history of orthodontic treatment. All participants underwent osteopathic examination (standardized protocol) and osteopathic correction of the identified somatic dysfunctions.

Exclusion criteria: diagnosis of «tension headaches associated with somatic pathology».

Tension headache is not associated with such etiological factors as physical activity and active stimuli like light, smell or sound. Unlike migraines, such headaches are not typically concomitant with nausea and vomiting. Tension headaches stem from the following: sleep and rest disorders, emotional stress, somatic dysfunctions of the temporomandibular joint (TMJ), degenerative disk disease (in cervical spine, in particular), and eye strain, especially that caused by electronic devices with excessively bright screens. The headaches can last from 30 minutes to 2–3 days. Clinically, there are episodic and chronic tension headaches distinguished. Fire percent of this group's patients had a third molar extracted 1–3 months before the onset of cephalgia.

Processing the results, we applied parametric and nonparametric methods. The data were systematized and visualized using Microsoft Office Excel 2013. SPSS Statistics (version 2) enabled statistical processing. The differences were considered significant at $p = 0.05$.

RESULTS

Following a standardized protocol, we diagnosed the dominant somatic dysfunction and identified the primary biomechanical, neurodynamic, and hydrodynamic components underpinning it [19, 20].

Figure 1 presents the comparison of the osteopathic status indicators registered in treatment and control groups before osteopathic intervention. All patients with a history of orthodontic treatment had the said status dominated by local somatic dysfunctions in the head area (sphenobasilar synchondrosis, locally — interstitial somatic dysfunctions in the palatomaxillary suture, zygomaxillary suture, intermaxillary suture, frontomaxillary suture, temporomandibular joint, intraosseous somatic dysfunctions of the upper and lower jaws). In addition, at the regional level, we registered neck somatic dysfunctions (local dysfunction of C0–C1 and the below cervical spine segments) and pelvic somatic dysfunctions (local dysfunction of L5–S1).

Manual osteopathic correction techniques were chosen individually for each patient. In the context of osteopathic treatment, the physician proceeded top down, i.e., remedied global somatic dysfunctions first, then moved to the regional and subsequently local levels. "Somatic dysfunction" clinical guidelines were observed when correcting the dominant somatic dysfunction [19].

For most patients, the sequence of application of osteopathic techniques was as follows: pubic joint decompression, sacrococcygeal joint mobility restoration, L5–S1 mobility restoration, thoracic diaphragm balancing, upper aperture balancing, C0–C1 mobility restoration, sphenobasilar synchondrosis decompression, correction of the revealed interstitial somatic dysfunctions.

All patients underwent a control osteopathic examination (standardized protocol) after osteopathic correction of the identified somatic dysfunctions. Figure 2 presents the comparison of the osteopathic status indicators registered in treatment and control groups before and after osteopathic intervention.

Repeated examination confirmed a statistically significant decrease of the frequency of somatic dysfunctions, including those found in the dentofacial system and neck region, as well as their clinical manifestations.

DISCUSSION

This work investigates the effect of extraction of first or third molar as a significant etiological factor in the development of

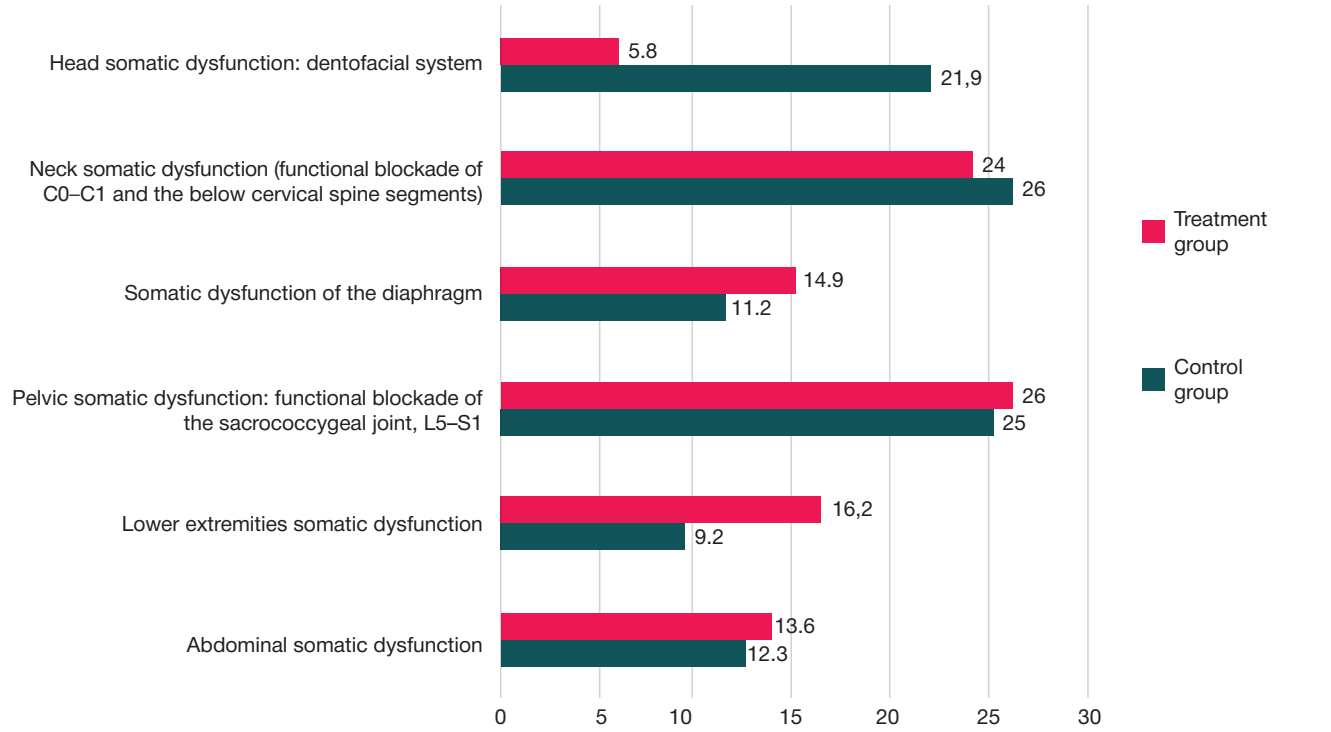

Fig. 1. Comparison of osteopathic status indicators, treatment group and groups, before osteopathic correction (%). * — $p \leq 0.05$

tension headache. The most prominent component of this factor are the traction and compression forces accompanying dental treatment.

We studied biomechanical, neurodynamic, hydrodynamic functional, and in some cases pathogenetic adaptation chains leading to the development of regional somatic dysfunctions, with such in the head and neck region being most common.

History of extraction of first or third molar and predominance of head somatic dysfunctions in the treatment group, including those affecting dentofacial system, allowed exposing the sequence of adaptive reactions of the body that translate into tension headaches initiated by etiological factors of intraocclusive nature.

Tooth extraction is associated with a combined effect of traction and compression forces on the upper or lower jaw. Consequently, there arise compression forces inside the bone, which initiate allostatic adaptive reactions at the local level. As a result, there develop somatic dysfunctions with a dominant biomechanical component, from the occipital bone and C1–C2 cervical vertebrae in the first place.

Pulling an upper jaw molar, dentist applies force to the entire head and neck region, which means that initially, before a more localized reaction, there appears sphenobasilar synchondrosis, mainly in the form of compression and torsion of varying severity. This condition may compromise the existing pattern of interaction between the sphenoid and occipital bones, and subsequently trigger adaptive reactions that contribute to the development of cephalgia. In the context of a tooth extraction, palatal bones accept biomechanical stress and, through the chain of interosseous suture interactions, transfer it to the sphenoid bone, and adaptation through connections with the zygomatic bone stresses the temporal bone. After extraction of a mandibular molar, diagnostics revealed somatic dysfunctions of the temporal bone in the first place.

In the context of adaptation to the mechanical etiological factors, anatomical biomechanical connections cause

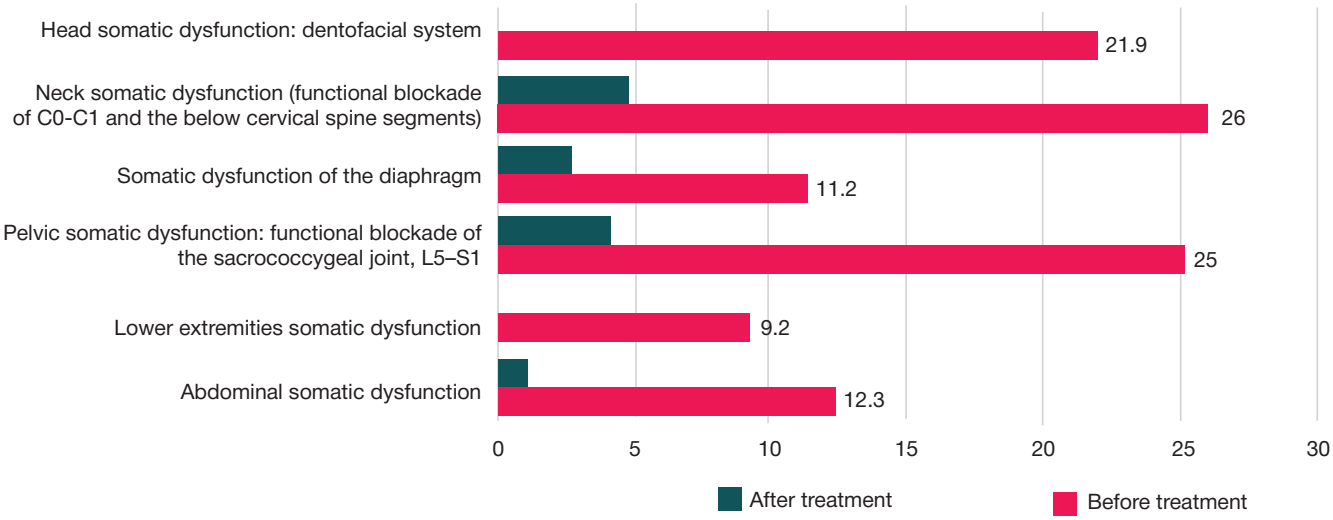

Fig. 2. Comparison of osteopathic status indicators, treatment group and groups, after osteopathic correction (%). * — $p \leq 0.05$

compression in the sutures between skull bones and brain membranes. By severity, the most common compressions are those in the zygomaticomaxillary, palatomaxillary, intermaxillary and frontomaxillary sutures; they cause functional intersuture somatic dysfunction.

The latter compromises mobility of the brain membranes. Somatic dysfunctions of the brain membranes affect venous circulation of the head region and cerebrospinal fluid dynamics. In turn, this can lead to a reflex response from the central nervous system and the autonomic nervous system, growth of the arterial and intracranial pressure. Increased intracranial pressure irritates receptors of the brain membranes' nerve endings and thus causes pain in the region of the head.

Based on the data yielded by this study, it can be assumed that the etiotropic trigger of development of the adaptation associated with tension headaches after molar extraction is the somatic dysfunction as part of the sphenobasilar synchondrosis, which is an adaptive reaction aimed at maintaining constancy of the internal environment.

As an adaptive reaction, somatic dysfunction is based on the pattern of skull bone positions formed at birth. As a result, there develop somatic dysfunctions that have neurodynamic and hydrodynamic components as the prevailing ones.

Other factors that condition development of somatic dysfunctions are extraction technique and position of the dentist relative to the patient during the procedure. Duration of extraction depends on complexity of the case; at a minimum, it lasts 40-60 minutes.

Mouth opened for a long time, rotations of the head and lateroflexion in the opposite direction may cause additional somatic dysfunctions in C0–C1, C1–C2, pleural dome ligaments, first rib, hyoid bone, musculoskeletal system of the stomatognathic system.

It should be noted that such position of the patient is peculiar not only to molar extraction but also to many other procedures in the context of orthodontic treatment.

Osteopathic diagnostics allows a conclusion that the primary somatic dysfunction is an intraosseous somatic dysfunction of the upper or lower jaw in the projection of the extracted molar. This is the area of primary damage. In such cases, the osteopath rehabilitates the patient by correcting somatic dysfunctions resulting from extraction of the first or third molar.

For this study, we used the osteopathic assistance protocol designed to remedy somatic dysfunctions (given below). It should be noted that the algorithm was developed following studies that investigated changes of functional activity of fibroblasts against the background of compression, hypercapnia, and hypoxia (simulated). It has been shown that compression, a local spike of pressure in the tissues, disrupts adaptive capabilities of connective tissue the most. Hypercapnia, reaction to high CO_2 content, was the second most potent etiological factor promoting development of the somatic dysfunction's hydrodynamic component at the local level. Hypoxia was shown to have the least effect thereon [18].

Thus, the revealed ranking of etiological factors affecting development of the somatic dysfunction at the local level can be expressed by the following algorithm. Remediation of compression at the local and regional level. Osteopathic techniques (standardized method) enabled decompression. In case of a diagnosed sphenobasilar synchondrosis compression, the decompression sequence began with the sacrum, L5–S1, thoracic diaphragm, and then C0–C1; afterwards, we retested and rebalanced integrity of the body's biomechanical mobility.

Initial correction of the thoracic diaphragm and pelvic diaphragm and adjustment of the venous sinuses after correction of sphenobasilar synchondrosis allow, in turn, to improve and restore venous circulation function and minimize the effects of hypercapnia at the local and regional levels.

However, it should be noted that, in connection with a molar extraction, there are two more reasons for cooperation between an osteopath and an orthodontist:

the patient may apply for osteopathic assistance after emergency extraction of any tooth, with rehabilitation and correction of the resulting somatic dysfunctions often preceding complaints;

the patient may apply for osteopathic assistance before a scheduled extraction of any tooth, with dental and osteopathic prevention measures taken to mitigate complications that may arise following the said extraction.

In such a case, osteopath's task is to diagnose somatic dysfunctions that may aggravate after tooth extraction.

Many orthodontists know that inviting an osteopath to participate in the post-extraction rehabilitation makes the entire process more effective and minimizes risks and complications. Therefore, the patient is referred for consultation to an osteopath before scheduled tooth extraction, and if extraction is emergency — after it, for rehabilitation.

Depending on the algorithm used, treatment can consists of several stages; its plan, as well as that of diagnostics, is similar for cases of emergency molar extraction and patient referrals driven by complaints.

Scheduled treatment implies dental and osteopathic preparation of the patient for tooth extraction:

Stage 1: consultation with a dentist before scheduled tooth extraction, US examination of head and neck vessels with the aim to diagnose disorders of venous and arterial circulation in the head region, and learn the effect of these factors on the adaptive abilities of fibroblasts, including synthesis of collagen, elastin and glycosaminoglycans;

Stage 2: primary visit to the osteopath, including diagnosing of primary or leading somatic dysfunction, osteopathic correction of the dominant somatic dysfunction and elimination of its cause, improvement of the body's adaptive capabilities with the aim to ensure homeostatic constancy of the internal environment;

Stage 3: if necessary, two or three more visits to the osteopath within two weeks. In case there is limited time available before dental treatment, the therapeutic part of osteopathic care should be performed 72 hours before it. This period of time was established based on the results of investigation of adaptive capabilities of fibroblasts (main connective tissue cells) after elimination of the etiological factors triggering somatic dysfunction, and tissue's return to the normosthenic conditions at the local and regional levels;

Stage 4: repeated dentist appointment before tooth extraction, followed by the specialized dental intervention;

Stage 5: implementation of rehabilitation measures, which may include the provision of osteopathic assistance and physiotherapy.

The algorithm of osteopathic care for patients during orthodontic treatment developed by us in the context of this study has been introduced to the practice of the Tyumen Institute of Manual Medicine.

CONCLUSIONS

The algorithm implies sequential elimination of compression factors (using osteopathic techniques) as markers of

neurodynamic and hydrodynamic disorders, subsequent remediation of hypercapnia that stems from the impairments of venous circulation and lymphodynamics, restoration of arterial circulation, and remediation of hypoxia and tissue nutrition disorders. Practiced, this protocol, involving interdisciplinary cooperation between an osteopath and an orthodontist, with joint patient management and cross-counseling, allows early diagnosis and timely correction of the identified somatic dysfunctions of dentofacial system, and, moreover, prevention of their development during orthodontic treatment. Osteopathic adjustments are a non-invasive component of the comprehensive dentofacial system abnormalities treatment programs, which allows their active application with the aim to optimize the treatment algorithm, improve the quality of medical care and effectiveness of specialized orthodontic therapy.

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