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General principles of the diagnosis and treatment of patients with temporomandibular disorders

MAŁGORZATA PIHUT¹ , MAGDALENA ORCZYKOWSKA¹ , ANDRZEJ GALA¹ ,
GRZEGORZ OSMENDA² , MAŁGORZATA KULESA-MROWIECKA³ 

¹ Prosthodontic and Orthodontic Department, Dental Institute, Jagiellonian University Collegium Medicum, Kraków, Poland

² Department of Internal Medicine and Gerontology, Clinic of Internal Medicine and Geriatrics, Jagiellonian University Collegium Medicum, Kraków, Poland

³ Department of Rehabilitation in Internal Diseases, Faculty of Health Sciences, Jagiellonian University Collegium Medicum, Kraków, Poland

Corresponding author: Małgorzata Pihut, Prof., M.D.
Prosthodontic and Orthodontic Department, Dental Institute
Jagiellonian University Collegium Medicum
ul. Montelupich 4, 31-155 Kraków, Poland
Phone: +48 601 441 400; E-mail: malgorzata.pihut@uj.edu.pl

Abstract: Temporomandibular disorder (TMD) is a condition affecting a growing population of people worldwide. It is an etiologically, diagnostically and therapeutically challenging condition. The aim of this article was to present difficult and important subjects for doctors, who are less experienced yet but who are treating patients with TMD. This article presents modern general methods for treating patients with temporomandibular disorders. The principles of treatment are described on the basis of the author's more than 30 years of clinical experience and taking into account the contemporary literature describing this issue. The therapeutic management of the use of appliances called occlusal splints is characterized, and the importance of stopping the pathological habits of clenching or grinding teeth is described. In addition, procedures such as intramuscular injections of botulinum toxin type A and intraarticular injections of hyaluronic acid have been described. Additionally, the physiotherapeutic procedures used, such as laser biostimulation, sonophoresis, postisometric muscle relaxation, or manual therapy, and the need for psychotherapeutic support are described. The description of the procedures includes valuable tips for each of the sections of primary and supportive treatment of TMD. This article highlights all the necessary steps in the treatment of this group of patients and offers an overview of the methods. This paper highlights the most innovative methods that are currently used in the treatment of TMD. The use of the described methods guarantees therapeutic progress and pain relief. In addition, the article explains the importance of psychological support due to the predominant etiological factors of TMD.

Keywords: temporomandibular disorder, treatment of TMD, management of TMD, splint, physiotherapy, botulinum toxin type A.

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Introduction

TMD (temporomandibular disorder) is the name for a collective syndrome of disorders, and a number of clinical problems concern the abnormal function of the masticatory muscles, temporomandibular joints and surrounding structures [1, 2]. Currently, it is one of the most significant causes of orofacial pain and discomfort in chewing food, speaking and dental pain. In TMD syndrome, the cause of pain is often overloading of the masticatory muscles rather than primary changes in the joints themselves. TMD has a multifactorial and complex etiopathogenesis. The most common symptoms reported by patients are as follows: pain at various locations, acoustic symptoms in the temporomandibular joints, such as crackling, popping and skipping; a limited range of mandibular inversion; and an abnormal path of opening movement of the mandible. The masticatory motor system is a complex morphological and functional unit [1–4].

TMD is a significant and growing problem among the populations of developed countries and a significant challenge for specialists in the fields of prosthodontics, orthodontists and dental surgeons. Owing to the multifactorial nature of this condition, diagnosis and treatment are not simple tasks for a doctor [4].

In the specialized diagnosis and treatment of temporomandibular disorders, there are general principles whose observance facilitates these procedures. Among the general principles of diagnosis, DC/TMD questionnaires or diagnoses based on the verification of individual stages are advisable. Assessment of the range and symmetry of mandibular movements, palpation of the masticatory muscles, temporomandibular joints, and assessment of acoustic symptoms in the joints during the execution of mandibular movements are of high importance. Among the intra-oral symptoms of TMD are wedge cavities, Mc Calla festoons, impressions on the tongue (indicating the presence of parafunction of clenching teeth), pathological abrasion of one's own teeth, and enamel damage (cracks). A valuable addition to the diagnosis of temporomandibular joint problems is MR examination and increasingly widespread ultrasound examination [1, 2, 5, 6].

Stopping parafunctional activity

With the widespread opinion that one of the main causes of TMD is prolonged parafunctional activity, often caused by excessive stress, one of the main principles of TMD treatment is to raise awareness of the harmfulness of this habit and to help stop the clenching or grinding of teeth — aimed at preventing parafunctions. This is a difficult task for the patient, similar to nail biting, but until the patient stops parafunctional activity, no other measures are effective (occlusion splints, botulinum toxin injections, physiotherapy treatments [1, 2, 5]). Clenching is often a result of stress or anxiety, so it is crucial to teach patients how to cope with stress through various supportive psychological techniques. To prevent tooth clenching, as part of self-therapy, patients should be advised to perform relaxation exercises for the chewing muscles systematically throughout the day [1, 5, 7]. Exercises may help improve muscle tension and reduce the urge to clench. Typically, we recommend performing approximately 15 exercises involving specific movements of the jaw, which are described below. In addition to the relaxation benefits for the muscles, these exercises help remind patients not to contact the dental arches together and control this condition as often as possible during the day. If clenching is severe or persistent, it may be good to consult a health-care provider, such as a general doctor or physical therapist, for further evaluation and treatment options. Support from psychotherapists is an indispensable part of TMD treatment because of

etiological factors. Any type of specialized treatment will be ineffective if the patient does not abandon parafunctional activity [7, 8].

Dental device

Various types of devices, called splints, are often used to treat TMDs, which are very important. The results of various studies on the use of splints in the treatment of TMD have revealed that these devices are 70% to 90% effective in reducing TMD symptoms [1, 5, 9, 10]. These devices are made of acrylic material with special designs or are pressed from thermoformable materials. Importantly, the immediate application of occlusal splints is not a good therapeutic solution: first, the patient should work on recognizing his masticatory system and the conditions during which he clenches his teeth or when he is aware of the necessary distance between both dental arches. Therefore, a good solution is to use occlusal splints after obtaining positive results from self-therapy and to check whether the patient complies with our recommendations (approximately one or two months) [9]. The use of occlusal splints at the beginning of treatment, without awareness of harmful habits, will be much less effective, as the patient will clench his teeth with the same force on the splint as on his own teeth. Most appliances alter the condylar position to either more musculoskeletal stable or more structurally compatible with better function [1, 4, 9].

Relaxation splints are often used, and they should have a special design: a flat occlusal surface, contact only the tops of the occlusal opposite cusps and incisal edges of the incisal teeth, and the so-called guidance of mandibular collateral movements on the canines. For this device, we recorded the interocclusal central relation of the mandible. Stabilization adjustments are the most important phase for providing an effective appliance, essential occlusion and comfortable fitting. Sometimes, it is necessary to correct the inner side of the splints [1, 10–12].

The second most frequently used device is repositioning splints, which are used to treat cases of disc displacement with reduction (without locking). The characteristic feature of these braces is that the mandible is forced into the anterior position during lifting. The splint typically has a smooth surface and a special ramp in the anterior section to prevent the teeth from joining the splint in the central position (Fig. 1). The anterior positioning appliance can be modified according to the preferred position of the mandible used for treatment with composite materials specifically designed for this purpose. The degree of anterior protrusion of the mandible depends on the position in which the clicking disappears. It should be the smallest mandibular protrusion at which the crackling sound disappears. The correct time to use the splint is 3 months, and then the device should be modified to a relaxation splint design [8, 9, 12].

If there is displacement of the articular disc (usually occurring on one side only), the patient should be instructed on the frequent use of anterior positioning of the mandible relative to the jaw, which is advisable, owing to the significant relief of pressure on the joints and the creation of conditions for the healing of damaged posterior disc ligaments [1, 12].

The use of occlusal splints plays many important roles in TMD management. These braces relieve pain by mechanically relieving pressure on the temporomandibular joints and relaxing the masticatory muscles and improve the coordination of jaw movements. The use of occlusal splints breaks the pathological habits of clenching teeth in the “favorite” occlusion position, when teeth in abnormal contact fit into each other. Occlusal splints cause a temporary and symmetrical distribution of occlusal bite forces, which has a beneficial effect on the masticatory muscles. Moreover, in cases of displacement of the articular discs, splints are responsible for the active repositioning of

these structures and the centralization of the articular heads. A reduction in the contact surface of the teeth with the splint contributes to a decrease in impulsion from the periodontal proprioceptors and a secondary decrease in increased muscle tension. It also eliminates occlusal obstructions and orthopedic instability of the mandible, which occur within natural teeth and are harmful to the proper functioning of the masticatory system [7, 9, 12].

In addition, occlusal splints prevent laterotrusive mandibular positions in which parafunctional activity occurs. From the point of view of differential diagnosis, for other types of facial pain, these braces can help to exclude the presence of TMD if their use does not provide relief of musculoskeletal pain of the masticatory system. Occlusal splints should be used for a strictly defined period of time. In the initial period, the splint should be used for approximately 21 hours a day. With proper use of the device (after approximately 3 months), the time of application of the splints should be systematically reduced. In the second or subsequent stage of prosthetic treatment, we proceed to replace missing teeth and reconstruct proper occlusal conditions [13–15].

Physiotherapeutic supportive treatment

Physiotherapy treatment is now an integral part of TMD therapy. It is a method of nonspecific stimulus treatment, an integral part of which is to achieve mobility of the masticatory organ. In addition, the purpose of the treatments is to stimulate tissues for repair processes; improve the mechanisms regulating the circulatory system; improve tissue trophism; reduce pain or decrease its intensity; improve blood and lymph circulation; relax the masticatory muscles; and improve the range of motion of the jaw. As the condition of the masticatory organ improves, the quality of life of TMD patients also improves [16, 17]. The vascular network and receptors of the skin, subcutaneous tissue and shallow muscles play a very important role in the effectiveness of treatment. The reflex arc is then activated: receptor — central nervous system — effector. Physiotherapeutic treatments alter receptor sensitivity, while improved circulation accelerates the removal of pain mediators and increases oxygen influx into cells, reducing further mediator release and improving nerve and muscle coordination [17–19].

In the course of TMD therapy, jaw exercises, i.e., autotherapy, are highly important and should be performed systematically by the patient. As emphasized in Wright E.'s textbook, exercise has the greatest potential for therapeutic benefits and enables patients to maintain improvement [1]. It is necessary to discuss the types of recommended exercises, the number of repetitions per day and the time required to achieve positive results with the patient in great detail [15, 19].

Among the most commonly performed treatments for TMD patients are manual therapy, massage, laser biostimulation, sonophoresis with anesthetic medicine in the form of a gel, radiofrequency, superficial heat and postisometric muscle relaxation. Physiotherapy treatments should be carried out immediately after diagnosis as an adjunctive treatment. Every few days, a series of 10 to 12 treatments should be performed. A common mistake is to apply treatments at a low frequency, that is, once every 3–4 weeks. This frequency is far too low for achieving positive treatment effects. The effects achieved by this method must overlap [15, 20–22].

The treatments should be accompanied by compliance with a soft diet, daily use of hot compresses on the side surfaces of the face (approximately 15 minutes on each side) and maintenance of a distance between the dental arches during the day [18, 21].

Psychotherapy in the treatment of TMD

Because psychoemotional disorders and the nervousness of patients are considered among the most important etiological factors, comprehensive treatment should include elements of psychotherapeutic support [23–26]. Psychotherapy should be conducted simultaneously with other forms of treatment and should be implemented as soon as possible after diagnosis. A very important element of this treatment is making the patient aware of the harmfulness of the habit of clenching their teeth and providing education in terms of coping with stress. Patient understanding of difficult issues translates into a solid approach to carrying out treatment recommendations [27, 28]. Conscientiousness in performing relaxation exercises and mental work to eliminate parafunctional habits such as teeth clenching or grinding. Cooperation should be undertaken with a psychologist who has experience with this group of patients. Important information in the field of psychotherapy is a guideline for dealing with evening hours. Emphasis is placed on the patient not working intensively in front of a computer screen and not meditating on difficult existential issues or professional and family problems. Many systematic reviews suggest that cognitive-behavioral interventions are beneficial for TMD patients and that this therapy may help patients reduce their conscious parafunctional behaviors [23, 25, 28]. Parafunctional activity occurs almost entirely below the level of consciousness, which is why patients are generally not aware of it. Cognitive-behavioral interventions, which primarily encompass behavior reversal, relaxation, hypnosis, biofeedback, and stress management, are very important in the treatment of TMD. Behavior-reversal therapy has been effectively used by psychologists for many years to treat nervous repetitive motion, such as cheek and lip biting, nail biting and tooth clenching. Many patients appreciate this kind of support from psychotherapists. Relaxation is known to reduce TMD symptoms and relieve TMD pain. Increased levels of emotional stress also activate the autonomic sympathetic nervous system, which can be a source of muscle pain. An important aspect of the prevention of parafunctional sleep activity is the observance of sleep hygiene, which, among other things, involves not focusing on emotional issues, such as professional and family problems in the afternoon [23, 25, 28].

Pharmacologic treatment

Pharmacological treatment of TMD complements other therapies. Medications are not often used, but in cases where masticatory muscle and/or temporomandibular joint pain is significant, medications with analgesic and muscle relaxant effects are helpful. While reversible nonpharmacological interventions are often recommended as first-line treatments, pharmacological options can play a crucial role in pain management. Tissue inflammation is very rare in the course of TMD. Simply taking up the therapeutic recommendations given to the patient (muscle exercises, physical therapy treatments, supplements) results in a decrease in the intensity of muscle and joint pain. The evidence clearly indicates that pharmacological treatment approaches differ between TMDs of muscular and arthrogenous origin. Therefore, it is very important to first identify individual and multifactorial etiologies and determine treatment strategies, including pharmacological treatment approaches [29–31].

The most common classes of pharmacologic agents used for TMD management are analgesics, anti-inflammatories, muscle relaxants, anxiolytics, and antidepressants. In addition, intramuscular injections of botulinum toxin type A (Fig. 1) and injections of hyaluronic acid and platelet-rich plasma are frequently used (Fig. 2). The toxin can be administered every 3–5 months. The

beneficial mechanism of action of botulinum toxin is to block nerve impulses between nerve cells and muscle and thus achieve a significant decrease in muscle tension. Most commonly, the toxin is administered to the masseter and frontal muscles. In the case of asymmetric growth of the masseter muscles, an appropriate, different dose of the toxin is administered [32].

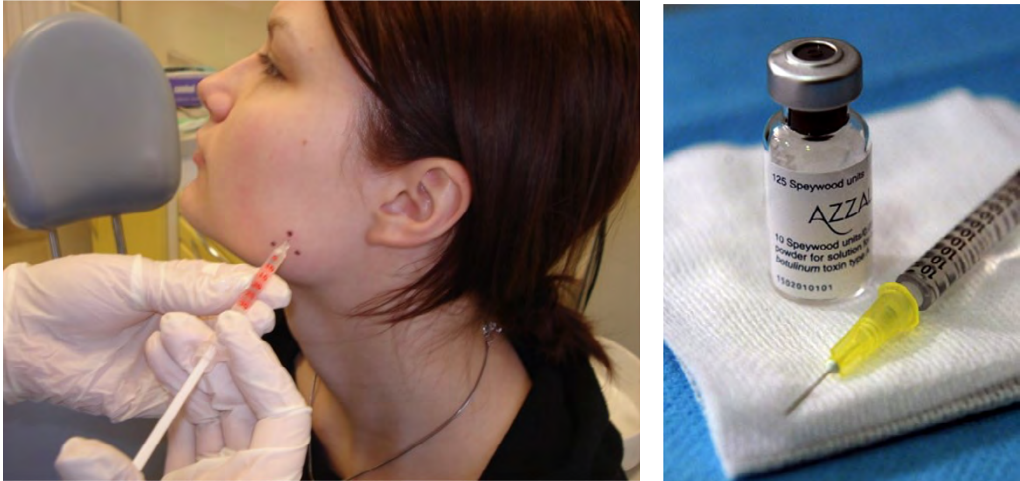


Fig. 1. Intramuscular injection of botulinum toxin type A.

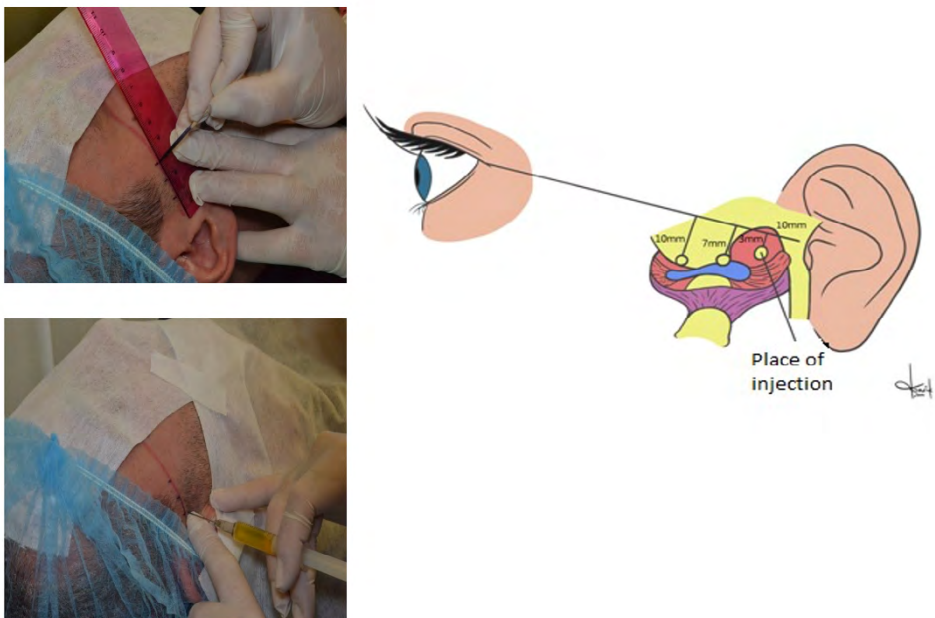


Fig. 2. Intraarticular injection of platelet-rich plasma.

Administration of acid and plasma directly into the joint itself has a beneficial effect on the healing of damaged soft-tissue structures in the temporomandibular joints. The above treatments should be performed in a series of 4–6 treatments every 2 weeks [32–34]. Salicylates, acetaminophen, ibuprofen, naproxen, and ketoprofen are the major analgesics available without a prescription. Importantly, when nonsteroidal anti-inflammatory drugs are prescribed, patients should supplement with gastric protective drugs at the same time. Steroid anti-inflammatory drugs are used very rarely because they can cause condylar degeneration [1, 5, 32].

The results of frequently used MRI and ultrasound imaging (USG) studies of the temporomandibular joints indicate the presence of numerous pathomorphological changes, so dietary supplements containing glucosamine and chondroitin are very useful. Both have a supportive effect on the joint surfaces and soft-tissue components of the joints [1, 4, 6, 35, 36].

Patient autotherapy

Importantly, self-therapy, which involves significant patient commitment in the treatment process, is very important in the treatment of TMD. This means that, first, patients should be made aware of the necessity of their own work in terms of daily mental struggle against the parafunctions of clenching or grinding their teeth. This should help by encouraging that the distance between the jaws be maintained throughout the day and that this position of the jaw be permanently controlled, that daily relaxation exercises be performed and that hot compresses be applied to the lateral surfaces of the face [1, 3, 5].

It is very important for patients to work to improve their psycho-emotional state. There are several methods of coping with stress that patients should learn. This is very helpful in daily life. There are a number of methods of general relaxation as well, which can be performed on their own. It is recommended not to work hard mentally in the evening, not to attend gymnastics, or working with the computer and in front of electronic screens to have more restful and effective sleep. It is also inadvisable to consume caffeine in the afternoon and eat hard foods [1, 4].

Conclusions

The treatment of TMD is complex (due to the complexity of etiological factors) and requires considerable knowledge and professional practice on the physician's part. Despite the necessary individual therapeutic approach, there are general principles of treatment that must be observed and developed for the benefit of the patients being treated. A certain limitation may be the insubordination of patients, who are reluctant to follow the therapeutic recommendations given by doctors.

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author contributions

All the authors contributed substantially to the study conception, drafting and critical revision of this work. All authors have approved the final version for publication and are fully accountable for all aspects of the work.

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