

Initial Treatment of Prosthetic Patients with a Michigan Splint

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Summary

The Michigan splint covers all occlusal surfaces of the dental arch and is used in initial prosthetic treatment during the diagnosis and treatment of temporomandibular disorders. The most frequent indication is myalgia of the masticatory muscles and arthralgia of the temporomandibular joint. The splint eliminates symptoms and realises self-positioning of the mandible into a new position, which is acceptable for the patient. It can be worn for a longer period with the object of protecting the hard dental tissue due to bruxism. Because of stability and retention on the base the upper dental arch is more frequently chosen. The occlusal surface of the splint is fabricated in the form of flat surfaces on which equal contacts of the working cusps of the antagonistic jaws are achieved in the area of freedom in the centric. In excursive movements of the mandible disocclusion of the remaining teeth is realised, guided by the canine. Interrupted wearing of the splint follows during an interval of gradual disuse and reduction in the period of wearing. Success of the treatment is conditioned by careful fabrication of the splint in the articulator, regular check-ups while wearing the splint and occlusal relations.

Key words: *initial prosthetic treatment, Michigan splint.*

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Treatment with splints

Prosthetic initial treatment includes gradual elimination of pain, sounds in the jaw joint and reduced movement of the mandible. Treatment is empirical, as it is based exclusively on the elimination of signs and symptoms of dysfunction. Indications for treatment with an occlusal splint are painful sensation in the area of the bilaminar zone, confirmed by passive compression, palpable sensitivity and pain in the masticatory muscles and the symptom of

clicking in the temporomandibular joint (TMJ), confirmed by dynamic manual procedures. Treatment with a splint is a form of conservative treatment of disc derangement, degenerative changes of the joint surfaces and myalgia of the masticatory muscle, with the aim of deprogramming muscle activity by excluding the influence of disrupted occlusal relations, i.e. occlusal instability of the dental arches and in cases of excessive wear of hard dental tissues due to parafunctional movements - bruxism (1-3).

Temporomandibular disorders

Temporomandibular disorders (TMDs) is a collective term for the condition of disordered function of the TMJ and/or masticatory muscle. They may be accompanied by orofacial pain, recurrent headaches and restricted movement of the mandible. Clinical signs are determined by manual and instrumental functional analysis, based on diagnostic symptoms and the patient's case history. The most frequent symptom of TMD is a pathological sound. Clicking is associated with disc derangement, and crepitation with degenerative arthritic changes in the functional joint surfaces (4-9).

Epidemiological studies offer numerous data on the prevalence of signs and symptoms of TMDs in all age groups, most frequently between the ages of 20 and 45 years, and more often in women. Regarding the different approaches to examination of patients and evaluation of relevant data and performance of functional analyses it is difficult to compare investigations and arrive at unique conclusions (10-12).

The aetiology of TMDs is multicausal. Specific factors can have a different role in the predisposition, causes and maintenance of TMDs, depending on the case. The condition of adaptation of craniomandibular structures is described as the reaction of tissue to specific possible causes (risk factors) of dysfunction. Symptoms, i.e. subjective disturbances, occur when possibilities of individual adaptation or compensation of particular parts of the TMJ and the stomatognathic system are exceeded (13).

Diagnoses of TMDs are classified into three basic groups: disordered muscular function, disc derangement and degenerative joint disease (14). Diagnoses which describe tissue-specific conditions (1) describe pathological changes in a certain tissue, due to which specific symptoms of TMDs arise. Possible vector loading, which is important when planning and carrying out treatment, is determined by specific manual procedures. The state of compensation/regressive adaptation is determined by manual examination procedures, i.e. decompensation of individual structures of the TMJ and relevant muscle (1,15).

Michigan splint

Initial nonspecific treatment of TMDs can be realised by a Michigan splint, according to Ramfjord

and Ash, which was developed at Michigan University (USA) with the object of treating dysfunction of the TMJ and muscle, and control of bruxism. It consists of a bite splint with flat surfaces on which occlusal stability of the dental arches is ensured. It is used as a means of prosthetic initial treatment in the relaxation of the structure of the masticatory system, repositioning of the disk and self-positioning of the condyle of the TMJ into a physiological position, within the TMJ (16-18).

The flat surfaces of the splint create contact between the dental arches by covering all the teeth, in order to avoid their movement, and growth and movement of the splint from its base. Occlusal contacts are achieved between the working cusps of all the teeth and the flat surfaces of the splint (Fig. 1). In this way free movement in the centric relation is ensured in the retral contact position (RCP). The flat and smooth occlusal surfaces of the splint with ensured occlusal contacts and freedom in the centric, facilitate realisation of self-positioning of the mandible. Freedom in the centric should be ensured with an area of 0.5 mm in the direction of protrusional and laterotrusion movement, in order to achieve subjective comfort while wearing the splint. Each eccentric movement of the TMJ should result in disocclusion of all lateral and anterior teeth by approximately 1 mm (Figure 2a), apart from contact on the canines (Figure 2b).

The Michigan splint has wide indication in the diagnosis and treatment of TMD:

- Occlusal trauma
- Severe or deteriorated bruxism
- Stabilisation of mobile teeth (periodontopathy)
- Easier maintenance of the centric relation
- Disordered function of the TMJ and muscle; symptoms of orofacial and craniocervical pain, tension headaches, subjective auditory disorders and tinnitus.
- A means of differential diagnostics of TMD in relation to other diseases with similar symptoms.

Fabrication in the laboratory

Models of the dental cast are placed in the articulator by means of a face bow and RCP-registration, at the approximate height of the future splint (Figure 3). All the interdental areas on the dental cast,

and the undermined places buccally beneath the cervical edge, and the deep cavities and fillings on the occlusal surfaces and all undermined places palatally, are coated with wax. In order to prevent contraction of the acrylic the palatal surfaces of the anterior and posterior teeth are coated immediately, up to the incisal ridges and palatal cusps. The edges of the splint are drawn on the model of the maxilla so that they include the incisal ridges of the anterior teeth slightly more than 2 mm and the buccal surfaces of the posterior teeth over the equator in the cervical direction. The palatal border follows the dental arch, encompassing the hard palate in the shape of a horseshoe and finishing behind the last molar. On the palatal part of the splint stability and retention are ensured during wear. The peripheral/marginal area of the splint is placed in a block of a continuous layer of wax, which is placed inside the palatal border and vestibular end of the splint (Figure 4). The raised vertical dimension of the splint must create disocclusion of the dental arches. Comfortable wearing of the splint is ensured by unobstructed contact of the lips, while swallowing, during sleep and speech. The thickness of the splint should enable the necessary grinding during wear. The incisal post of the articulator controls the vertical dimension. The dental cast is isolated and the area envisaged for the splint filled with a layer of softened wax, which is adapted to the base. The dental cast of the mandible is also isolated and pressed into softened wax so that the incisal post of the articulator touches the incisal table in the desired vertical dimension. Excess wax is removed and the shape of the splint modelled so that only the lower buccal cusps of the posterior teeth and the incisal ridges of the anterior teeth touch in the occlusal surface of the splint. Occlusal contacts can be tested with powder or occlusal paper. This is followed by waxing the surfaces guided by the canine, which take over each excursive movement outside freedom in the centric of 0.5 mm and must not obstruct realisation of contact in the RCP. The surfaces guided by the canine must be slightly indented and by their angle/inclination they must avoid any interfering contact with the other teeth, including the incisors (Figure 5). With the final shaping of the occlusal surfaces and edges of the splint, the whole wax model is placed in a block of rubber impression material or plaster. After hardening the wax is

removed from the area of the splint. The entire base of the splint is isolated and prepared for filling with acrylic paste. Cold polymerisation acrylic is used (Futura Jet, Schütz Dental). Around 10 ml of monomer is mixed with polymer. In order to remove remaining air bubbles the mass is poured in a thin stream from the container into another container. The container is then covered in order to prevent evaporation of the monomer. The material consistency paste is applied to the whole area of the splint. The mass is closed in the block, the surplus pressed/forced out and secured with a rubber band. For better polymerisation and prevention of porosity the splint is immediately placed in a compressive pan.

Wearing in the mouth and eventual problems

The polymerised splint is replaced on the model in the articulator in order to check and grind the occlusal relations (Figure 6). After which its surfaces are analysed and polished, while the final check of occlusal relations follows when the splint is handed over to the patient.

The splint must fit impeccably on the base in the mouth of the patient, without swaying/shifting and with good retention and stabilisation. A milling machine is used to carefully remove possible obstructions when placing in the area of the vestibular edge of the splint. The splint must not press on individual teeth and such areas should be alleviated by grinding from the inside. The thickness of the vestibular edge and height of the splint should not unduly obstruct speech and relaxed position of the lips.

Control of occlusal relations follows after checking the base of the splint. The working cusps of the posterior teeth and incisal ridges of the anterior teeth of the mandible create simultaneous contact with the splint surface (Figure 7). As in the wax model, the centric occlusal contacts must have freedom in the centric of around 0.5 mm forward, backward and laterally. Contacts are tested by occlusal paper during habitual closing of the mouth, and then contacts in RCP. Such occlusion is comfortable for the patient and facilitates self-positioning of the mandible. Protrusional and laterotrusion movements are achieved after contact in the area of freedom in the centric on the modelled surfaces for guiding by the canine. In this way disocclusion of posterior and anterior

teeth is achieved of around 1 mm (Figure 8). Control is performed by objective attainment of the desired static and dynamic contacts. Subjectively, this ensures comfortable wearing of splint for the patient, which is achieved by good stabilisation and finely treated surface.

The patient should be informed of the purpose of wearing the splint, the expected effect of the splint on the disorders caused by dysfunction and the need for wearing and hygiene of the splint. The splint should be worn during the day and night, except during meals and personal hygiene. However, this may be restricted to wearing the splint at night and partially during the day, if the upper splint is a problem during speech. The splint may provoke and increase secretion of saliva and change the sense of taste in the mouth. The first control check-up is performed the day after handing over the splint to the patient.

Data in the patient's report refer to satisfactory retention and stabilisation on the base, and the period in which it was worn. The splint should be comfortable and fit well in the mouth. Even partial wearing of the splint eliminates acute symptoms. Objective finding is connected with determining signs of TMD (clicking, pain, restricted mouth opening), examining occlusal relations and habitual mouth closing and contact in the area of freedom in the centric. Occlusal analysis can be carried out with immediate grinding in the patient's mouth or by remounting in the articulator.

Expected effect of splint wear

Improved functional condition depends on regular control of occlusion and polishing/grinding of interference (contacts outside freedom in the centric). Wear should not be conditioned by promises that symptoms will completely disappear, but rather that they will be significantly reduced. During wear the splint must fit well, and excessively worn occlusal surfaces and surfaces guided by the canine, including broken off parts of the splint, must be repaired with acrylic. By wearing the splint self-positioning of the mandible into new occlusion should be realised, with no subjective disorders, which is suitable for the patient. The Michigan splint can be worn for a longer period with the object of protecting hard dental tissue, due to bruxism.

Interrupted wearing of the splint follows during an interval of gradual disuse and reduction in the period of wearing. Permanent interruption of wearing the splint must be conditioned by the patient's comfortable acceptance of his own occlusion, i.e. with the permanent treatment of oral rehabilitation. During analysis of occlusion on models and the planning of prosthetic definite treatment, transfer of the achieved position of the mandible should be transferred to the articulator.

Conclusion

Occlusal splints are used in the initial treatment of TMD. A large number of splints have been described in the literature with regard to application, appearance and length of treatment. The Michigan splint is indicated in cases of myalgia of masticatory muscle, arthralgia of the TMJ and protection of dental tissue from excessive wear, i.e. protection of the periodontic apparatus from occlusal trauma. Thus, apart from being a relaxing splint, the Michigan splint is used as a stabilising splint in the case of inadequate and disrupted occlusal relations and for repositioning in the treatment of disc displacement. In clinical application the Michigan splint has proved to be uncomplicated in initial treatment of muscular pain and TMJ. It has no particular contraindications and is of noninvasive character, such as for example, a repositional splint. During treatment it is important to take into account the patient's judgement and analyse the occlusal relations of the splint. When wearing the Michigan splint good results are also achieved by elimination of the clicking caused by anterior movement of the disk. The principles of definite treatment complement each other: selective grinding, prosthetic treatment and orthodontic/surgical treatment. Prosthetic definite treatment includes: elimination of the disorder, occlusal comfort, favourable vector loading, removal of the occlusal risk factor in the occurrence of parafunction and long-term occlusal stability by the realisation of natural abrasion. The object of functional treatment, and thus of the Michigan splint, is the achievement of comparable physiological loading of individual parts of the masticatory system (1, 2, 18-21).