MANAGEMENT OF THE TEMPOROMANDIBULAR DISORDER PATIENT WITH CONCURRENT NEED FOR RESTORATIVE DENTISTRY – A CASE REPORT

Protetična oskrba pacienta s temporomandibularno motnjo – prikaz kliničnega primera

A. Obrez, C.S. Greene, J.C. Türp

Abstract

While not common, it is possible that a patient who needs extensive occlusal/restorative rehabilitation will present with concomitant signs and symptoms of orofacial pain, frequently diagnosed as a painful temporomandibular disorder (TMD). The presence of musculoskeletal facial pain may significantly affect mandibular reference positions and/or limitations of mandibular movements, which in turn may interfere with routine prosthodontic clinical procedures. It is for this reason that any definitive prosthodontic treatment should be deferred until the facial pain has been properly managed. In patients who need an extensive occlusal rehabilitation, it is very important that the clinical procedures are properly sequenced and based on currently accepted clinical concepts related to the occlusal rehabilitation of a compromised dentition. This paper discusses the clinical management of a TMD patient with concurrent need for significant restorative/prosthodontic treatment.

Izvleček

Sicer ni običajno, da ima pacient, ki potrebuje obsežno protetično oskrbo, sočasno znake in simptome orofacialne bolečine, ki je pogosto diagnosticirana kot boleča temporomandibularna motnja (TMM). Prisotnost mišično-skeletne bolečine lahko bistveno vpliva na referenčne položaje spodnje čeljustice in omejitev gibanja spodnje čeljustice, ki lahko posledično motijo rutinske protetične postopke. Dokončno protetično oskrbo je treba zato odložiti, dokler obrazna bolečina ni ustrezno obravnavana. Pri pacientih, ki potrebujejo obsežno protetično rehabilitacijo, je zelo pomembno, da se klinične postopke izvajajo v pravilnem zaporedju in da le-ti temeljijo na veljavno sprejetih kliničnih konceptih, ki se nanašajo na protetično oskrbo pomanjkljivega zobovja. Ta članek obravnava klinično oskrbo pacienta s TMM, ki sočasno potrebuje obsežno protetično oskrbo.
Introduction

Though prosthodontic and temporomandibular disorder (TMD) patients are usually two distinct and heterogeneous groups of patients, they may overlap within their respective age groups. Typical TMD patients are women within the child-bearing age (Howard, 1991), while patients who are in need of prosthodontic care are more or less equally distributed between the genders and belong predominantly to the middle and older age groups. Hence, it is not a surprise to see some patients who are in need of a prosthodontic rehabilitation and who at the same time report orofacial pain (Plesh and Stohler, 1992; Türp and Strub, 1996; Obrez and Türp, 1998). These patients can be classified into several distinct groups according to the temporal relationship between their reported pain and prosthodontic treatment that they need. This paper focuses on management and treatment of a patient that presents with both an urgent and elective need for restorative rehabilitation and concurrent orofacial pain.

For adequate treatment planning, certain maxillo-mandibular registrations are routinely used, namely (1) height and orientation of the occlusal plane, (2) vertical dimension of occlusion (VDO), (3) centric relation (CR), (4) lateral and protrusive mandibular border movement records, and (5) maximum intercuspation (MI). The accuracy and validity of registration of some of these occlusal parameters, as well as the treatment outcome of prosthodontic rehabilitation itself, may be significantly affected by the presence of TMD-related pain. It is, therefore, the intent of this paper to stress the importance of management of musculo-skeletal facial pain as it relates to the timing and sequencing of the planned prosthodontic procedures. To make this paper more clinically relevant, it is presented within the framework of a clinical case.

Clinical case

A 39 years old healthy female patient presented in the office with the following complaint: "I have a dull, achy pain around my face lasting at least five months, with an occasional pop in my right side jaw joint that is sometimes painful. In addition, my tooth (pointing to tooth No. 21) aches whenever I bite on it. I also think that my teeth look terrible and with so many teeth missing I have a problem eating. Now I am finally financially able to pay for my dental work and willing to receive dental care."

Upon further examination, the reported orofacial pain was described as dull, persistent, with an intensity of 6/10 (0: no pain; 10: the worst pain one can imagine), and radiating to the neck and shoulders. The clinical examination revealed that the odontogenic pain was clearly localized (tooth No. 21) and non-referring. A significant limitation of maximum mouth opening (MMO=35 mm) was accompanied by a mandibular deviation to the right (3 mm). Palpation of both lateral temporomandibular joint (TMJ) areas confirmed a painful right side TMJ click during mandibular opening only.

Intra-oral examination revealed several missing teeth (Nos. 12, 15, 16, 18, 25, 28, 36, 37, 38, 46, 47, 48), positional change of teeth (distally rotated tooth No. 24, supra-erupted teeth s Nos. 11 and 27, and lingually positioned tooth No. 44), fractured teeth (Nos. 13, 21, 22, 23), carious lesions (teeth Nos. 13, 17, 21, 22, 23, 28) and teeth with significant occlusal wear (Nos. 33--43) (Fig. 1). None of the teeth were mobile, and there was no significant gingival recession and/or dental furcation involvement. Panoramic and full mouth periapical radiographs confirmed periapical lesions on teeth Nos. 21 and 23, endodontically treated teeth Nos. 13, 22 and 23, and mild to moderate generalized alveolar bone loss (Fig. 2).

![Figure 1: Pre-operative photo of the patient's dental status, frontal view.](image-url)
Vertical and horizontal incisal overlaps were 9 mm and 4 mm, respectively. The existing maximum intercuspation did not coincide with centric occlusion (CO, defined as the initial point of tooth contact when the mandible is in CR; this mandibular position usually does not coincide with MIF).

Due to several supra-erupted teeth, the patient's plane of occlusion was not harmonious. Though she wore a removable mandibular partial denture, it was described as ill-fitting. Overall, her oral hygiene was inadequate, as demonstrated by numerous areas of visible dental plaque adhesions.

In summary, the patient presented with three concurrent pain complaints: (1) persistent myofascial pain, (2) acute odontogenic pain on tooth No. 21, and (3) episodic right side TMJ arthralgia associated with anterior displacement of the TMJ disc with occasionally painful reduction upon jaw opening.

The patient's other major complaints were related to her missing and broken teeth, some with significant carious lesions. Therefore, her existing oral status could be summarized as decreased oral function and compromised esthetics.

**Proposed sequence of the patient's treatment**

1. **Urgent treatment care**

   To alleviate the acute odontogenic pain, the first clinical procedure was an emergency endodontic treatment of tooth No. 21. The tooth was temporized and the final endodontic treatment was postponed until her toothache and orofacial pain were successfully managed.

2. **Management of orofacial pain**

   a. **Rationale for its priority**

   The presence of orofacial pain has a significant effect on registrations of maxillo-mandibular relationship that are an essential part of both the initial treatment planning phase as well as the permanent prosthodontic treatment (Obrez and Stohler, 1996). The influence of pain ranges from its effect on registration of mandibular border movements (e.g., protrusive and lateral) to registration of reference treatment positions (e.g., CR, closure into MI, VDO), all of which are routinely used in extensive prosthodontic rehabilitation (Plesh and Stohler, 1992; Türp and Strub, 1996; Obrez and Türp, 1998).

   For example, Obrez and Stohler (1996) showed that experimentally induced pain in the masseter muscle decreased the length of the protrusive mandibular border movement that is used to set the inclination of the articular eminence on an articulator. Pain also affected lateral border movements with respect to both the length and their orientation relative to the midline, as well as the location of CR. It needs to be emphasized, however, that there is a considerable inter-individual and task-dependent variability of mandibular movements as a consequence of the pain (Theusner et al., 1993; Sae-Lee et al., 2008).

   b. **Essential therapeutic considerations**

   Temporomandibular pain is a musculoskeletal type of orofacial pain, which arises from the TMJ and other intracapsular structures, or from the muscles and tendons which move that joint. Hence, the dentist should adopt the role of an oral pain physician. As a rule – and similarly to other parts of the body affected by musculoskeletal pain (e.g., the lower back) – the therapy of these conditions should primarily be based on reversible and conservative management modalities (De Boever et al., 2008; de Leeuw, 2008). Patient education about the specific TMD diagnoses, their clinical relevance, the prognosis, and therapeutic options is of utmost importance, because outcomes are significantly affected by patient understanding and cooperation.

   The typical initial modality of the management of masticatory muscle pain would usually include an oral appliance (Türp et al., 2004; Klasser and Greene, 2009), but taking this approach in this
case would be very difficult due to the patient’s oral status: there were simply not enough teeth present in either arch to fabricate a stable oral appliance. It was, therefore, necessary to rely on other conservative management strategies, beginning with the instructions for home care with moist heat packs applied to the sore muscles, mild exercises, and deep massage of affected muscles, as well as limitation of diet to soft foods (Michelotti et al., 2005; Clark, 2008). Professional intervention could include physical therapy (Orlando et al., 2006), analgesic and muscle relaxant medications (Hersh et al., 2008), and psychological approaches, such as cognitive-behavioral therapy and relaxation training.

It has been shown that a combination of somatic and psychological methods is likely to yield better therapeutic results than a somatic therapy alone (Turk et al., 1993; Turk et al., 1996; Dworkin et al., 2002a; Dworkin et al., 2002b). Multimodal, interdisciplinary therapeutic strategies are particularly useful for the management of individuals with long-standing chronic TMD pain conditions, due to the impact of major psychological involvement in such cases (Türp et al., 2007).

3. Diagnostic and planning phase of the prosthodontic treatment

a. Essential therapeutic considerations

Our patient presented with an occlusal scheme that was neither functional, nor comfortable, nor esthetic. It was, therefore, necessary to provide her with a prosthetic rehabilitation that would consider her static and dynamic occlusal relationships. Because some of the occlusal factors (e.g., plane of occlusion, VDO) were significantly changed and not acceptable to the patient, her oral rehabilitation required the implementation of a concept of an "ideal" therapeutic occlusal scheme. The latter attempts to provide an optimized relationship among the teeth from both the anatomic and functional aspects, and it is regarded as the most appropriate for a wide range of maxillo-mandibular and tooth relationships. Since there are several concepts of an "ideal" occlusal rehabilitation available, it is very important that the chosen therapeutic occlusal scheme is considered on an individual basis. Due to the lack of evidence for clinical superiority of the more complex occlusal protocols, there is currently a growing trend towards the selection of simpler therapeutic occlusal concepts and procedures (Greene and Obrez, 2003; Türp et al., 2008).

The following part of the paper describes the sequence of the clinical assessment and restorative treatment planning as they relate to the case presented here.

b. Mounting the diagnostic casts

In order to provide the patient with a prosthodontic treatment that is visualized in advance, e.g. before the rehabilitation actually starts, the case was properly diagnosed and planned. From the prosthodontic point of view, the most accurate and straightforward approach is to mount the casts of the case on an articulator that is able to reproduce the patient's mandibular border movements. In most cases, a semi-adjustable articulator is sufficient to provide the clinician with a visual perspective of the patient's existing static and dynamic occlusal relationships, and allow to proper planning of the intended prosthodontic rehabilitation. Mounting the casts on an articulator is especially recommended in those clinical cases where (1) there are not enough teeth to hand articulate the casts; (2) there is a need for reproducibility of tooth relationships; (3) there are discrepancies within the occlusal plane; (4) there is a need to change the patient's VDO; (5) there is an exaggerated slide from centric occlusion into MI; (6) there are balancing interferences which disclude the working side during laterotrusion; (7) the diagnostic wax-up and final restorations involve occlusal surfaces of teeth. Most of these requirements were met by our patient.

The three-dimensional transfer of the maxillary diagnostic cast to the transverse horizontal axis of the articulator may involve the use of a face-bow. Though its use in removable prosthodontics has been recently questioned (Carlsson, 2009), use of the face-bow in full-mouth rehabilitation reduces the error of hand articulation, especially in cases when the anterior teeth, the dental arch symmetry and the plane of occlusion are all being restored at the same time. Our patient is therefore, an example of a clinical case where mounting the diagnostic casts using a face-bow transfer is strongly recommended.
c. Determining the therapeutic plane of occlusion

The initial step in the assessment and diagnosis of an occlusal relationship is the evaluation of the height and orientation of the occlusal plane. In our patient, the diagnostic phase revealed that both the patient's height and orientation of the plane of occlusion were not uniform due to several supra-erupted teeth and loss of posterior support. Though a frontal view during the patient's smile gave an initial impression that the maxillary anterior tooth No. 11 was supra-erupted, it was not until further evaluation of the height of the occlusal plane by (1) performing a phonetic test (e.g., pronunciation of “f” sound), (2) observing the amount of incisor display during rest (approx. 2–3 mm), (3) measuring the length of the central incisor (approx. 11 mm), and (4) observing the position of the lower lip when smiling, that the initial diagnosis was confirmed.

The next step was to determine the amount of the incisor supra-eruption and, therefore, the anterior point of the newly established therapeutic plane of occlusion. Using the clinical evaluation described above, it was determined that though the coronal portion of tooth No. 21 was broken, the position of its existing incisal edge was at the correct height of the occlusal plane. Thus, the position of its incisal edge was used as a reference for the anterior point of the newly established height of the plane of occlusion (Fig. 3).

![Figure 3: Diagnostic wax-up, frontal view.](image)

This procedure was followed by assessing the anterior and sagittal orientation of the plane of occlusion. Due to missing lateral maxillary incisors and broken maxillary cuspids, the inter-pupillary line was used as the extra-oral reference to determine the anterior transverse orientation of the occlusal plane. Alternatively, the horizontal orientation of the plane of occlusion can be related to the vertical axis of the face. Using the ala-tragus line to determine the antero-posterior orientation of the occlusal plane, it was confirmed that tooth No. 27 was supra-erupted into the opposing edentulous space. Thus, the newly established plane of occlusion was subsequently used as a guide for the diagnostic wax-up of the teeth in the maxillary arch. At this point, the attempt was made to level both the antero-posterior and transverse aspects of the occlusal plane (decreasing the curves of Spee and Monson) in order to reduce the chance of balancing and protrusive occlusal interferences (Fig. 4).

![Figure 4: Diagnostic wax-up, right side view.](image)

d. Determining the therapeutic VDO

VDO has been defined as the vertical maxillo-mandibular relationship when teeth are in occlusal contact (Boucher, 1953). When occlusal contacts between the maxillary and mandibular teeth are inadequate or unstable, VDO must be determined by the clinician. Among the various methods, determination of vertical dimension of rest (Pleasure, 1951; see also Rivera-Morales and Mohl, 1991) and phonetic tests (Silverman, 1953) have become two of the most frequently used clinical methods for determining the VDO. By using both methods it was determined that the patient's VDO was indeed decreased and that an increase of 2 mm in the anterior sextant was necessary to achieve an appealing esthetic and functional result.

e. Determining the antero-posterior mandibular therapeutic position

In an attempt to establish a reproducible maxillo-mandibular relationship in patients without
posterior support or a stable interocclusal relationship, the concept of CR has been advocated. The definition currently in use (The Academy of Prosthodontics, 2005) defines CR as the maxillo-mandibular relationship in which the condyles articulate with the thinnest avascular portion of their respective disks in an antero-superior position against the posterior slope of the articular eminences.

CR may change over time (Piehslinger et al., 1993; Shafagh et al., 1975). It is for this reason that some clinicians advocate a "slide in centric" or "freedom in centric" concept, which provide a patient with the possibility for a mandibular slide 1 mm anteriorly and approximately 1 mm antero-laterally from the established centric occlusion (CO – defined as the initial point of tooth contact when the mandible is in CR) without any change in the VDO. Because of the patient's already existing exaggerated slide in centric, it was decided that this particular type of maximum intercuspation should be incorporated into the newly established therapeutic occlusal scheme.

4. Pre-prosthodontic rehabilitation

Before the final prosthodontic rehabilitation was initiated, an elective endodontic treatment was performed on tooth No. 21, followed by the endodontic retreatment of teeth Nos. 13, 22, and 23, and the extraction of tooth No. 27, which was significantly supra-erupted. If the tooth had been kept, it would have necessitated significant removal of its crown structure resulting in a prosthodontically indicated endodontic treatment that the patient declined due to financial reasons.

Though tooth No. 21 was significantly shortened in its length, the occlusal height of its incisal edge was determined as clinically acceptable. As such, it was used as a guide for the length of the clinical crown of tooth No. 11. After accepting this new length of the maxillary incisors, and to achieve the esthetic result with respect to the length of the maxillary incisors, periodontal surgery (crown lengthening) was performed in the region of the maxillary anterior teeth. In order to determine the apical extent of the periodontal surgery, the ideal plane of occlusion was first incorporated into the diagnostic maxillary cast and then the desired modifications verified with the patient. After her approval, the cast with the diagnostic wax-ups and modified height of the gingival margins was duplicated in stone. The duplicated cast was then used to fabricate a clear surgical guide reflecting the desired extent of the crown lengthening and providing the periodontist with the guide for surgery (Figs. 5 and 6).

Figure 5: Clear stent of a duplicate diagnostic wax-up cast used for fabrication of the surgical guide.

Figure 6: Surgical guide in place prior to the periodontal surgery indicating the extent of the crown lengthening.
5. Prosthodontic rehabilitation

After the period of periodontal healing, prosthodontic rehabilitation was initiated. Figures 7 and 8 demonstrate the effect of crown lengthening. In addition to providing the periodontist's guidance for crown lengthening, the surgical guide was subsequently used to fabricate temporary crowns after teeth Nos. 14-16, 13-23, 24-25, 34-35, 33-43 and 44-45 were prepared for full coverage porcelain-fused-to-metal crowns (Fig. 9). The temporary crowns represented the therapeutic occlusal scheme that included newly established (1) height and orientation of the occlusal plane, (2) VDO, and (3) height of the maxillary incisors and canines after periodontal surgery.

Teeth Nos. 13, 22 and 23 received cast posts and cores to replace missing coronal tooth structure. All carious lesions (teeth Nos. 13, 17, 21, 22, 23 and 28) were restored prior to taking final impression of the tooth preparations. All the teeth were restored by porcelain-fused-to-metal restorations (Fig. 10). Since the patient was not interested in receiving dental implants or a distal extension mandibular partial denture, both mandibular premolars were cantilevered posteriorly in order to maintain the occlusal contacts with the maxillary first molars.

6. Oral appliance

After completion of the prosthodontic rehabilitation, the patient received a maxillary stabilization appliance (modified Michigan splint) to be worn during sleep (Fig. 11). The appliance, which was fabricated from hard acrylic resin, was approximately 2.0 mm thick in the canine area and had a flat occlusal surface. The latter allowed the patient to move the mandible from CR in protrusive and/or lateral directions without any restriction. After insertion and adjustment, the appliance was re-evaluated within one and two weeks.
Conclusions

The intent of this article was to discuss the clinical management of a patient with persistent TMD problems, an acute odontogenic pain, and concurrent need for major restorative/prosthodontic treatment. Since the presence of a musculoskeletal facial pain might have significantly affected routine prosthodontic clinical procedures that were part of this extensive oral rehabilitation, management of the acute and persistent pain became the primary focus of the clinician's initial attention. After successful treatment of the acute pain and management of the persistent pain symptoms, the oral rehabilitation was initiated, utilizing clinical procedures that were based on valid and currently accepted clinical concepts. The paper concludes with a detailed description of the sequential steps required to complete this complex case.

Acknowledgements

We would like to thank Dr. Hirant Bicakci, resident, Postgraduate Prosthodontics Program, College of Dentistry, University of Illinois at Chicago, for the use of the clinical case presented in this paper, and Dr. James Buckman, Professor, Department of Restorative Dentistry, College of Dentistry, University of Illinois at Chicago, for comments on an earlier version of this manuscript.

Reference


A. Obrez, DMD, PhD, Associate Professor, Department of Restorative Dentistry, College of Dentistry, University of Illinois at Chicago, USA; C.S. Greene, DDS, Professor, Department of Orthodontics, College of Dentistry, University of Illinois at Chicago, USA; J.C. Türp, DMD, PhD, Professor, Clinic for Reconstructive Dentistry and Temporomandibular Disorders, Dental School, University of Basel, Switzerland.

Direct correspondence and requests for reprints to Dr. Ales Obrez, Department of Restorative Dentistry, University of Illinois at Chicago, College of Dentistry (MC 555), 801 South Paulina Street, Room 204K, Chicago, IL 60612-7211; phone 312-996-4977; fax 312-996-3535; aobrez@uic.edu