OREC PANORAMA 3/2024

Special Issue - Orthodontics & Oral surgery

Treatment of TMD in Orthodontics & Highlights of the 5th Sino-German Symposium

In this issue, we want to present first time a few topics within the field of orthodontics as well as oral surgery. As always a master thesis, conducted this year at the IMC, will be presented as well as related background, accompanied by useful product information. The respective master topic, dedicated to Correlation and Treatment Concepts of Temporomandibular Disorder (TMD) in Orthodontic Treatment, is closely related to some topics included in the congress on **TMJ and Related Skeleton Surgical Treatments** - only recently conducted as a hybrid conference in the framework of the annual Sino-German Symposia. On the following pages we would like to present some of the highlights (pages 2 & 3) and a selection of lectures specifically related to the field of orthodontics (pages 4 & 5). For those who are interested in more details, the complete congress proceedings are freely available as short excerpts and can be found in the **Archive of Orofacial Data Science**.

Prof. Dr. Joos (Editor)

5th Sino-German Symposium

For the 5th time the Sino-German Symposium (SGS) took place on October 14 and 15, with this year's focus on various aspects of surgical procedures on the temporomandibular joint surgery. The symposium, organized by the International Medical College University of Duisburg-Essen (IMC) in Münster and Shanghai Jiao Tong University, School of Medicine, College of Stomatology (China) was held for the first time not only online but as a hybrid event with more than 100 participants on site in Münster and additional participants participating online from all over the world.
The conference rooms on the top floor of the Atlantikhotel in Münster provided an outstanding setting for the excellent specialist presentations, dialogs with the associated specialist exhibitors as well as networking during the breaks, framed by excellent culinary delights and an enchanting view of the of the autumnal cityscape. A total of 36 specialist presentations by renowned speakers primarily from China and Germany were supplemented by international contributions from England, France, Spain and Brazil. The topics of the talks distributed on four sessions spanned a broad arc through the world of maxillofacial medicine. Intensive discussions between the presentations and during the breaks illustrated the importance of professional exchange across national borders.
The detailed presentation of the minimally invasive technique of arthroscopic discopexy developed by Prof. Chi Yang of the Shanghai Ninth People's Hospital was a particular highlight of the event (see more on pages 2 & 3), specifically as the practical skills could be learned and deepened in a subsequent practical course.

Fig. 1: *Participants of the 5th Sino-German Symposium (photo: P. Niebergall)*

Fig. 2: *Awarding of the Ruth Erwig Prize (photo: P. Niebergall)*

Last but not least with the **Ruth Erwig Prize** awarded by the German Surgical Foundation special advances in the field of dental surgery were recognized to Florentine Hüttel and her team for their work on developing an interactive augmented reality tool (HoloPointer) enabling real time annotation on a laparoscopy monitor for intraoperative guidance. The exclusive feature of this innovative application is based on exclusive control via verbal commands and head movements to ensure a sterile workflow. In the respective **study** the majority of trainees improved their surgical performance using the HoloPointer in elective laparoscopic cholecystectomies, and the rate of classic but potentially misleading corrections was noticeably reduced.

Yang's arthroscopic discopexy

Disc displacement is a common disorder affecting the temporomandibular joint. According to the guidelines of the American Society of Temporomandibular Joint Surgeons and the American Society of Maxillofacial Surgeons, interventional methods including arthroscopy and open surgery are recommended for patients suffering from chronic pain or dysfunction who do not respond to conservative treatments.

Since Annandale first described the surgical repositioning of the displaced disc in 1887, many modified techniques for repositioning the temporomandibular joint disc have been propagated with varying success rates. Later, **Yang et al**. introduced a modified arthroscopic technique of disc repositioning and suturing for anterior disc displacment (DD) with a success rate of 95.42%.

The displaced disc can be categorized into pure anterior displacement and rotational displacement (anteromedial and anterolateral). Here we want to present the outcomes of a new technique developed in Prof. Yangs´ group, where specifically an arthroscopic discopexy for **rotational anterior disc displacement** is performed. The detailed outcomes are published by **Liu et al. (2019).**

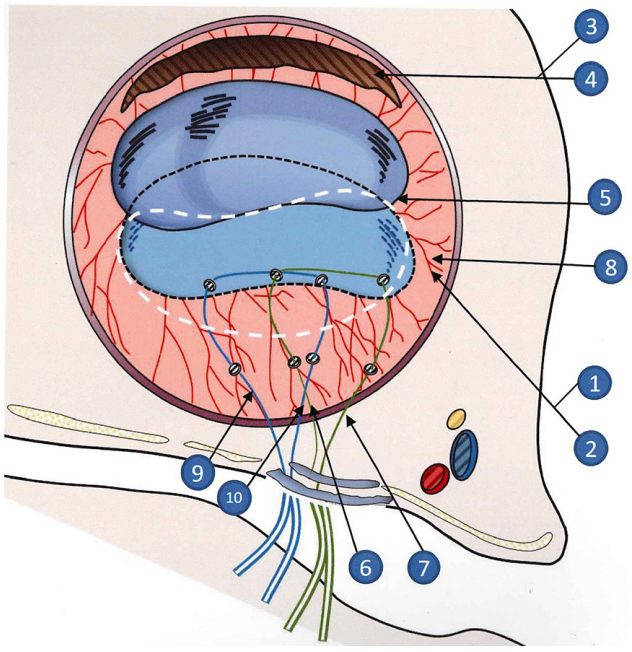


Fig. 3: *Overview on consecutive steps in Yang's arthroscopic discopexy*

The retrospective study was conducted on patients with rotational anterior DD, at the Ninth People's Hospital, Shanghai Jiao Tong University School of Medicine (China) with following **inclusion criteria:** (1) patient diagnosed with rotational anterior DD according to the criteria of **Foucart** (anterolateral or anteromedial) on preoperative magnetic resonance imaging (MRI); (2) Wilkes stages II, III, or IV, with no response to prior conservative treatments; (3) the arthroscopy treatment. **Exclusion criteria** were (1) septic arthritis or synovial chondromatosis, (2) disc perforation, (3) lack of pre- and/or postoperative MRI, and (4) previously operated joints.

The surgical procedure consisted of a combination of anterior release, disc reduction and disc suturing - performed through five to six incisions (as shown in detail on page 3).

After 1 week postoperatively, mouth opening exercises were started. Pain in the healing phase was assessed using a visual analog scale (VAS) from 0-10, and the success rate was determined by clinical and MRI evaluation. The study was conducted on 532 patients (72.4% female) treating 749 joints (408 anterolateral, 341 anteromedial), patient age was from 13 to 63 years (mean 21.23 ± 3.53 years).

A **success rate of 95.3%** (714 joints) was calculated based on MRI evaluation at 24 months postoperative: the disc was found to be repositioned in both sagittal and coronal images, and new bone formation was identified on the apex of the condyle. The most relevant outcomes on pain and mouth opening are shown in **Table 1**. Postoperative complications were encountered in only 13 joints.

Table 1 – main outcomes presented as mean ± SD

Time point	Pain [VAS]	Mouth opening [mm]
Baseline (t_0)	2.06 ± 2.13	26.65 ± 7.87
1 month	2.08 ± 2.27	26.91 ± 7.02
6 months	0.96 ± 1.56*	32.68 ± 6.37*
12 months	0.79 ± 1.24*	34.02 ± 6.12*
24 months	0.73 ± 1.43*	34.73 ± 6.28*

* significant difference to baseline ($p < 0.001$)

Compared to purely anterior DD, the surgical procedure for rotational anterior DD is more difficult and complicated, as the disc must be reduced in both the sagittal and coronal directions. Therefore, the puncture technique and the direction of the suture are the most important points for success. By choosing the **first point** 1-2 mm backward from the intersection of the posterior slope of the eminence and the condylar process, injury to the blood vessel bundles can be effectively avoided and bleeding during the puncture can be reduced. Arthroscopy through this puncture not only allows a clear view of the entire superior glenoid cavity, but also leaves sufficient space for further surgical procedures.

Further, the complete release of the anterior attachment from medial to lateral with only 2 mm depth plays an important role in achieving a complete disc repositioning. However, specifically in case of anterolateral DD, the strong lateral ligament makes it difficult to perform the release of the lateral part of the anterior attachment. Regarding anteromedial DD, the anatomical weakness of the condylar medial sulcus potentially obstructs the anterior release of the medial attachment to be conducted under direct arthroscopic visualization. Therefore, the **2nd puncture site** for anterolateral DD was moved more backwards from the anterior surface of the eminence in order to cut the lateral part of the disc, and for anteromedial DD it was moved more forwards to cut the medial part of the disc.

For disc reduction, the ideal **3rd puncture point** is usually 10–15 mm ahead of the first one. For rotational DD, this puncture was moved more backwards (antero-lateral) or forwards (anteromedial) to ensure that the 12-gauge suture needle was nearly parallel to the horizontal axis of the disc. Furthermore, the third puncture site was required to be made above the lowest point of the eminence in order to avoid the challenge following disc suturing.

The **suture technique** also differed to that in pure anterior DD. The suture was fastened in a backwards and inwards direction for anterolateral displacement, or a backwards and outwards direction for anteromedial displacement to allow for the anterior/posterior (sagittal) and the inner/outer (coronal) disc reposition simultaneously.

This new technique is effective in **early** dysfunction but is often inadequate in long-standing cases of DD, where a thick posterior ligament is making arthroscopic repositioning difficult and often unstable. A benefit is the better joint biomechanics in arthroscopic discopexy compared to open surgery. However, as the technique is complex, regular training is required. The surgeon should be experienced in open TMJ surgery and possess excellent arthroscopic puncture and triangulation skills.

Individual steps in Yang's arthroscopic discopexy

On this page we give a detailed image based overview on the most relevant steps involved in Yang' s arthroscopic discopexy.

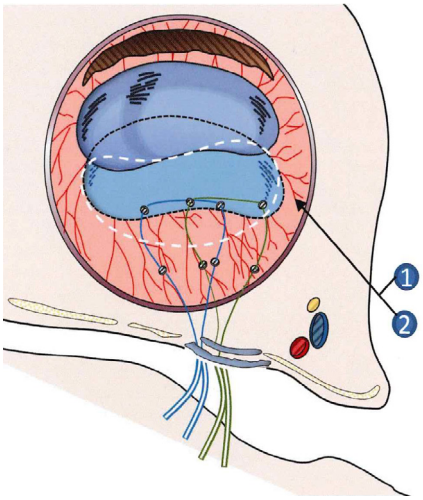


Fig. 4: Steps 1 & 2: Local anaesthesia and location of first arthroscopic puncture

The procedure starts with local anaesthesia to avoid pain, bleeding and to expand the joint cavity. Next the trocar is inserted the arthroscope placed along the trocar (Fig. 4). For this step, the patient should adopt an open-mouth position. The posterior slope of the articular eminence and the condylar process are marked and the first puncture site should be located 1–2 mm backwards from intersection of those two lines.

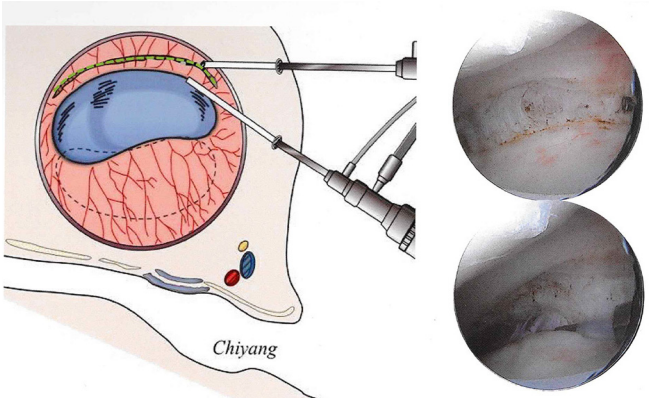
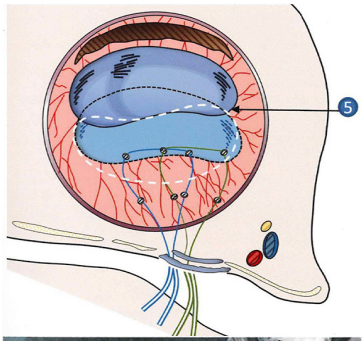


Fig. 5: Release of anterior attachment: The incision line is located approximately 2-3 mm anterior to the anterior band of the disc.

The second puncture for the anterior release is then placed on the body surface parallel to the arthroscopic cannula (mouth closed now), which goes into the anterior recess and ends in the outermost part of the lateral cavity (Fig. 5).



For disc reduction, the third puncture is made between the first two puncture sites (Fig. 6).

The needle penetrates the disc in the border of disc and retro-discal tissue and is then returning to the upper joint cavity from the medial border (Fig. 7).

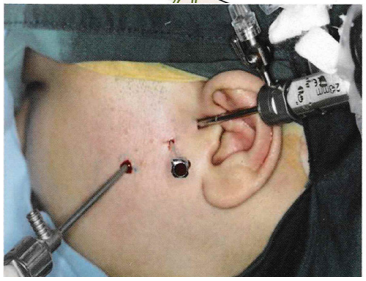


Fig. 6: Insertion site of the joint disc reduction needle: located approximately at the midpoint of the two trocars

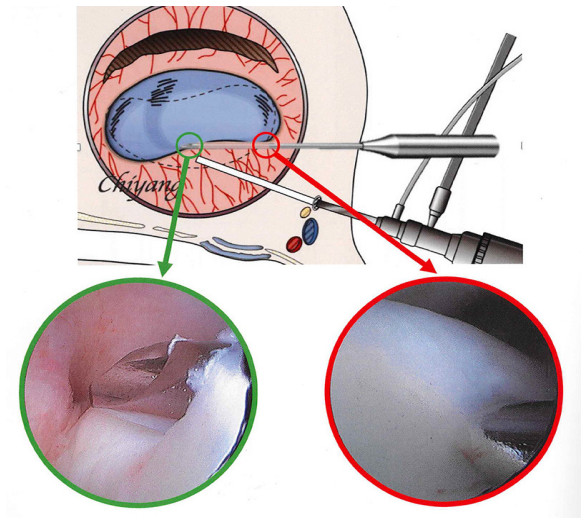
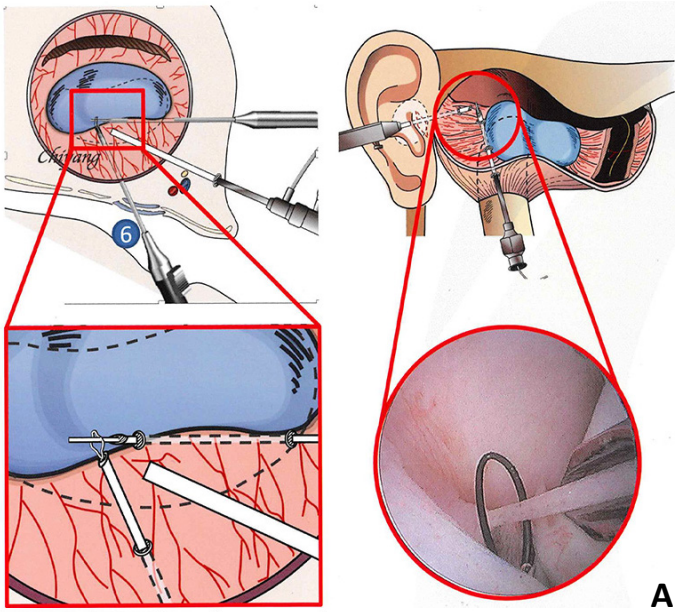


Fig. 7: Positioning and movement of the joint reduction needle



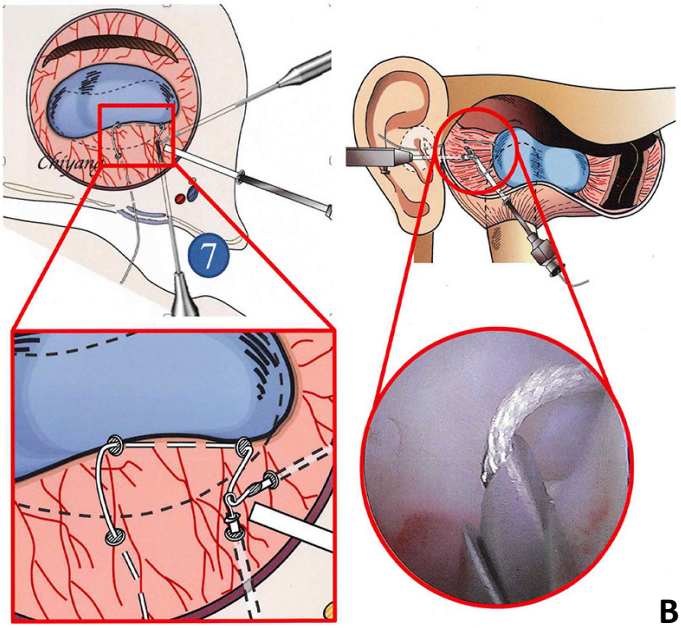


Fig. 8: Further punctures to insert two customized suture grippers to catch the surgical suture (medical woven polyester with an inner core) from 12-gauge needle:
A: Insertion of first lasso-type suture gripper to catch surgical suture
B: Insertion of another hook-like suture gripper for the second suture
(Fig. 3 - Fig. 8 from Prof. Yang's brochure, with consent)

Temporomandibular Joint

Scientific background

Functional orthodontics is an orthodontic treatment concept that uses passive removable appliances in the oral cavity to functionally stimulate the soft and hard tissues of the masticatory system in such a way that they change their functional patterns and react with adaptation and growth. A functional orthodontic appliance works on both the upper and lower jaw at the same time. It is used to correct the position of the upper and lower jaw and to improve breathing, tongue function and lip closure. Depending on the malposition of the jaw, the growth of the upper or the lower jaw is either inhibited or promoted. The theoretical approach is to see the craniomandibular system (CMS; stomatognathic system, Fig. 9) as a functional unit of hard tissues such as the skull, cervical spine and jaw bones and the soft tissues attached to them, such as the shoulder, lip, cheek and tongue muscles.

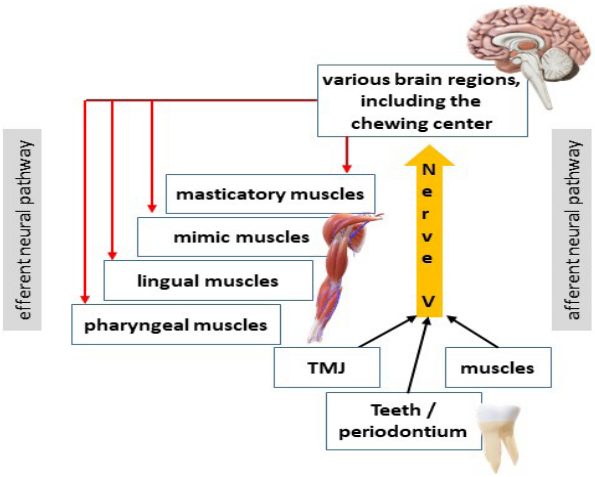


Fig. 9: *The stomatognathic system (image by C. Keil)*

Radiological diagnosis of the TMJ in MRI

Prof. Kinzinger presented various specific patient cases in which adolescent patients were treated for class II malocclusion with a removable functional orthodontic appliance (FMA) or fixed FMAs over a period of about seven to nine months. At baseline, all patients presented with severe overbite and molar occlusion. After treatment, a marked therapeutic effect was observed with both removable and fixed FMAs, with measurable improvement in overbite due to both skeletal and dental advancement. To clarify whether the theory proposed by Prof. Kompusch regarding the remodeling processes in the TMJ is correct, magnetic resonance imaging (MRI) was used to assess the condylar position. Since MRI is noninvasive and allows for careful examination even in pediatric populations, it can be used to visualize the processes of bone remodeling in both the condyle and the fossa. The images illustrated the initial condylar placement, subsequent advancement, and final repositioning into the glenoid fossa after three months of treatment. Subsequent imaging demonstrated a return of the condyle to a centric position within the fossa (Fig. 10).

The analysis included longitudinal examinations of the disc-condyle relationships, considering metrics such as disc angle at various time points before and after treatment. The study confirmed that although persistent changes were detected, the duration of treatment was carefully controlled, with optimal treatment lengths of between six and nine months documented. Metric evaluations examined significant changes in the anatomical dimensions of the condyle and its relationship to the fossa in all participant groups. However, the overall results showed only minimal changes in the dimensions of the condyle after treatment.

Functional mandibular advancement (FMA) has become an effective treatment for skeletal class II malocclusion, and it is commonly used in adolescence who still have growing potential by having mandibular forward positioning to stimulate mandibular growing and bone remodeling processes. As early as 42 years ago, Gerda Komposch, a highly respected German orthodontist, published the theory that bone formation at the posterior edge of the condyle and at the posterior edge of the glenoid cavity leads to a forward positioning of the mandible and thus treats Class II malocclusion. At the same time, however, bone resorption occurs in the anterior condyle area, which is accompanied by a posterior curvature of the postglenoid process. Ultimately, these changes contribute to mesial drift, which is characterized by a downward and forward displacement of the glenoid cavity and a distal cranial translation of the condyle. It was already assumed at that time that this could also be observed when using fixed appliances (Reference). Such findings are noteworthy, albeit not universally acknowledged, given that treatment via fixed orthodontic methods is well-documented and established. Cone-beam computed tomography (CBCT) is one possibility to diagnose TMD by examining the morphology of the condyles and determining whether the condylar position remains normal. The second possibility was presented by Prof. Kinzinger at the 5th Sino-German Symposium (see article below).

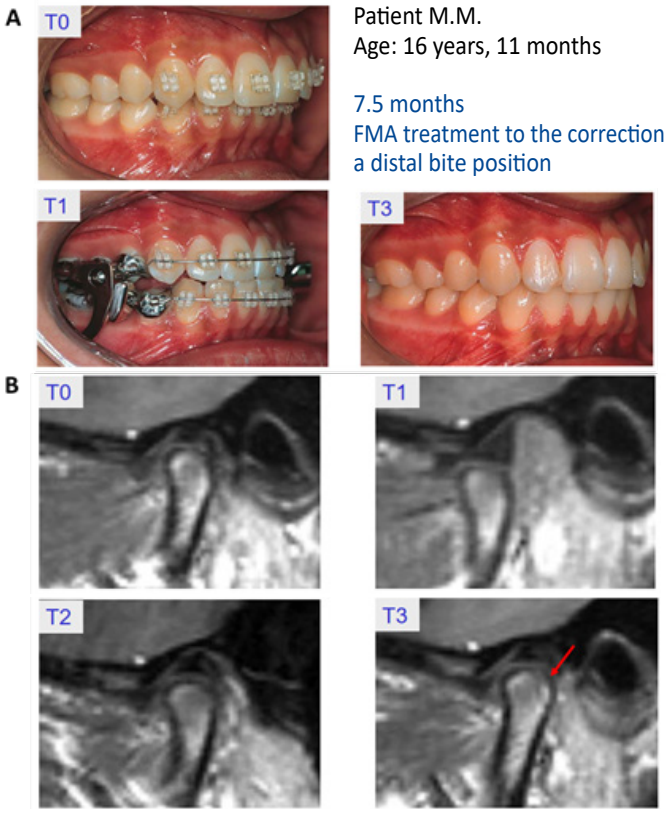


Fig. 10: *A) Intraoral position of an Angle Class II malocclusion before treatment (T0), during the fixed functional phase (T1) and after treatment (T3);*
B) MRI images before treatment (T0), during the fixed functional phase (T1), after 3 months of treatment (T2) and after treatment (T3) (image from 5th SGS)

In summary, MRI examinations can be used to visualize changes in the temporomandibular joint caused by orthodontic appliances. The discussion that fixed FMAs also trigger detectable remodeling processes in both the condyle and the fossa could be confirmed, although these appear to be less extensive than originally assumed. Current recommendations suggest that treatment with fixed FMAs may be most beneficial for patients with moderate class II malocclusions. For adult patients, fixed FKO devices are more of a therapeutic alternative to extraction therapy and less so for dysgnathia surgery.

Temporomandibular Disorders in Orthodontic Treatment

The relationship between orthodontics and temporomandibular disorders (TMDs) is of utmost importance to dental and craniofacial health. Clinicians and researchers have long believed that occlusion is one of the most important direct and/or indirect etiological factors leading to TMD. The anatomical relationship between tooth position and jaw function has long been recognized as the basis for the link between occlusion and TMD, as is the fact that people with misaligned teeth suffer from TMD more often than the general population. However, it is now also known that psycho-emotional stress can cause and/or intensify the symptoms of TMD. TMDs can include muscle and joint pain, disc displacement with or without joint noise, and pathologies that cause bony remodeling of the temporomandibular joint.

Because of the association between malocclusion, occlusal variables, and TMJ, it has been postulated that orthodontic treatment can prevent or alleviate TMD. On the other hand, it has also been repeatedly pointed out that orthodontic treatment can also cause or worsen TMD. The interaction between orthodontic treatment and changes to the TMJ was the topic of Dr. Shen's talk (see below).

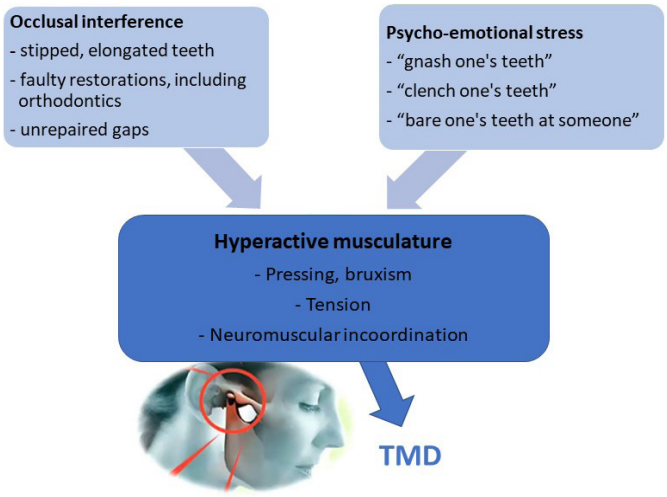


Fig. 11: *Causes and consequences of TMD (image by C. Keil)*

TMJ ADD: Surgery or conservative treatment? A RCT study

Speaker: Dr. Pei Shen, Shanghai, China

Dr. Shen´s research focus is the temporomandibular joint (TMJ) anterior disc displacement (ADD), one of the most common TMJ disorders. This disease can occur in all age groups, with a high prevalence in adolescents. Dr. Shen began her lecture with a case of an open bite that developed after orthodontic treatment. Closer examination revealed that the cause of the relapse was a resorption of the condyle. Relapses of this kind were frequently observed in her clinic.

In order to investigate these occurrences, two clinical studies were carried out. The studies should answer the following central questions:

- What is the natural progression and outcome associated with juvenile TMJ ADD?
- What changes occur following disc repositioning procedures?
- Can functional appliances effectively promote condylar growth and correct such deformities?

The first study included a retrospective, self-controlled case series that was designed to examine both the natural progression of TMJ disorder and the outcomes following disc repositioning in juvenile patients diagnosed with TMJ ADD. MRI and lateral and postero-anterior cephalometric images were used to analyze the height of the condyle and jaw deformities at different intervals, including an initial visit a week before surgery and subsequent follow-up appointments post-surgery. During the preoperative phase, patients were only offered supportive care, such as education about their condition. Therefore, this period was considered an indicator of the natural course of the disease. The study showed that the condylar height decreased and the jaw deformity worsened in the preoperative phase, while in the postoperative phase the condylar height increased and the jaw deformity improved. The results of this study suggest that in adolescent patients with TMJ-ADD, failure to reposition the disc can lead to resorption of the condyles, which in turn results in a decrease in condylar height and worsening of jaw deformities. In contrast, successful repositioning of the disc facilitates remodeling of the condyles, resulting in an increase in condylar height and subsequent correction of the jaw deformities.

A randomised controlled trial was presented to answer the question of whether functional orthodontic appliances could stimulate condylar growth and effectively address jaw deformities in patients with TMD-ADD. In this multi-centre clinical trial a cohort of 240 juvenile TMJ ADD patients was divided into two groups based on treatment protocols: participants in the joint occlusal group underwent arthroscopic disc repositioning surgery prior to functional appliance application, while those in the occlusal group did not. This study also analyzed the condylar height and the change in jaw deformities. It was found, that at the 8-month mark, the occlusal group presented a decrease of 0.75 mm in condylar height, whereas the joint occlusal group exhibited an increase of 1.57 mm. (See more on page 6.)

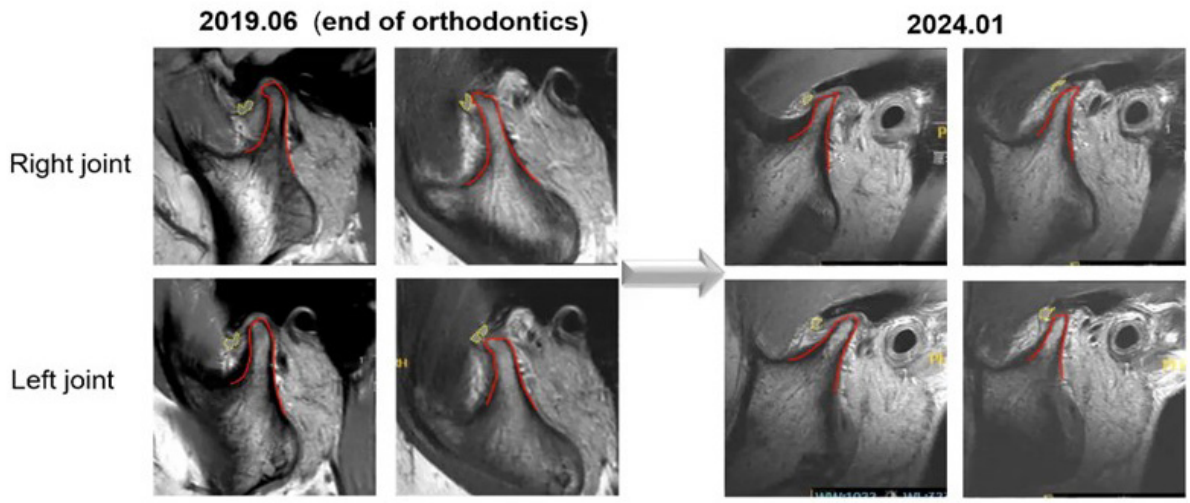


Fig. 12: *Case study of a patient with TMJ ADD with condylar resorption diagnosed as the cause of the recurring open bite five years after orthodontic treatment (image from 5th SGS)*

Related Master thesis

Correlation and Treatment Concepts of Temporomandibular Disorder in Orthodontic Treatment

Master of Science in Specialized Orthodontics - 2024

Objectives: The primary objective of this thesis is to investigate the association between TMD and orthodontic treatment. It aims to identify whether orthodontic treatments increase or improve TMD symptoms and to explore effective methods for alleviating TMD symptoms in orthodontic patients to ensure smooth progression of orthodontic treatment.

Material & methods: A systematic literature search on PubMed identified 21 relevantstudies published in the last 15 years. These studies included RCTs, CCTs, cohort studies, case-control studies, cross-sectional studies, observational studies, case reports, and survey studies. The focus was on the impact of various orthodontic treatments on TMD symptoms and methods for alleviating these symptoms.

Results: The impact of orthodontic treatments on TMD symptoms varied. Some treatments, like fixed appliances and AR splints, significantly improved TMD symptoms, while others, such as clear aligners with intermaxillary elastics, sometimes worsened them. Effective methods for alleviating TMD symptoms included occlusal splints, auricular acupuncture, physiotherapy, and exercise therapy.

Conclusion: The relationship between orthodontic treatment and TMD is complex. Some treatments improve TMD symptoms, while others may have neutral or adverse effects. Identifying high-risk orthodontic activities and using effective therapeutic interventions are crucial. A multidisciplinary approach offers the best promise for managing TMD and ensuring successful orthodontic treatment.

Key words: Temporomandibular Disorder (TMD), orthodontic treatment, Temporomandibular joint (TMJ), occlusal splints, intermaxillary elastics

continued from page 5: This trend continued to diverge at the 14-month follow-up, with the joint occlusal group showcasing further increases in condylar height, while the occlusal group experienced a continued decline.

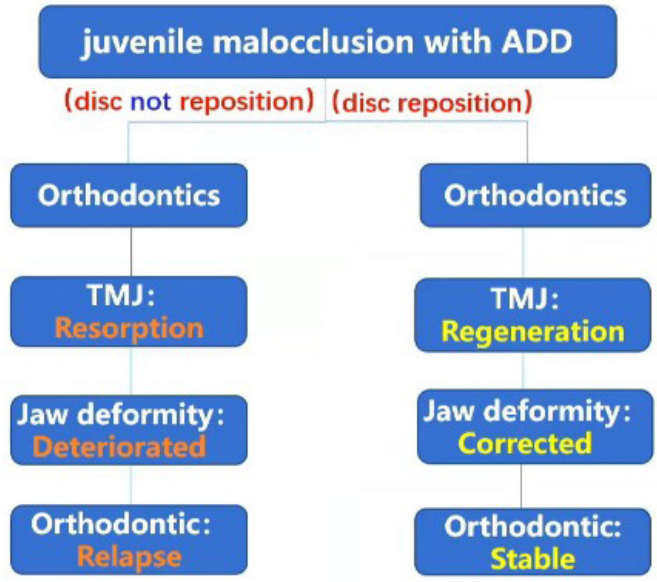


Fig. 13: *Summary of the results of the studies presented (image from 5th SGS)*

List of included studies

Aroca, J.P. et al. 2022. Auricular acupuncture in TMD - A sham-controlled, randomized, clinical trial. Complement Ther Clin Pract, 48:101569.

Chen, J. et al. 2022. Effects of occlusal splint and exercise therapy, respectively, for the painful temporomandibular disorder in patients seeking for orthodontic treatment: a retrospective study. BMC Oral Health, 22(1):527.

Coelho, T.G. & Caracas, H.C. 2015. Perception of the relationship between TMD and orthodontic treatment among orthodontists. Dental Press J Orthod, 20(1):45-51.

Karaman; A. & Buyuk, S.K. (2022): Evaluation of temporomandibular disorder symptoms and oral health-related quality of life in adolescent orthodontic patients with different dental malocclusions. Cranio, 40(1):55-63.

Kurt, H., et al. (2011): The effects of two methods of Class III malocclusion treatment on temporomandibular disorders. The European Journal of Orthodontics, 33(6), 636-641.

Manfredini, D. et al. (2015): Prevalence of static and dynamic dental malocclusion features in subgroups of temporomandibular disorder patients: Implications for the epidemiology of the TMDocclusion association. Quintessence Int, 46(4):341-9.

Mitsui, S.N. et al. (2016): Long-term stability of conservative orthodontic treatment in a patient with temporomandibular joint disorder. J Orthod Sci, 5(3):104-8.

Myllymäki, E. et al. (2023): Longitudinal trends in temporomandibular joint disorder symptoms, the impact of malocclusion and orthodontic treatment: A 20-year prospective study. J Oral Rehabil, 50(9):739-745.

Nelson, G. et al. (2012): Three-dimensional retraction of anterior teeth with orthodontic miniplates in patients with temporomandibular disorder. American journal of orthodontics and dentofacial orthopedics, 142(5), 720-726. 2(5):720-6.

Pancherz, H. et al. (2015): Signs and symptoms of TMJ disorders in adults after adolescent Herbst therapy: a 6-year and 32-year radiographic and clinical follow-up study. Angle Orthod, 85(5):735-42.

Pereira, N.C. et al. (2021): Frequency of awake bruxism behaviour in orthodontic patients: Randomised clinical trial: Awake bruxism behaviour in orthodontic patients. J Oral Rehabil, 48(4):422-429.

Pihut et al. (2022): Physiotherapeutic rehabilitation of adolescent patients with temporomandibular disorders. Folia Med Cracov, 62(3):79-90.

Pittar, N. et al. (2023): The effect of passive clear aligners on masticatory muscle activity in adults with different levels of oral parafunction. J Oral Rehabil, 50(12):1409-1421.

Prado, I.M. et al. (2018): Study of Associated Factors With Probable Sleep Bruxism Among Adolescents. J Clin Sleep Med, 14(8):1369-1376.

Ruf, S. & Bock, N.C. (2019): Long-term (≥15 years) effects of Class II treatment: a longitudinal and cross-sectional study on signs and symptoms of temporomandibular disorders. Eur J Orthod, 41(2):172-179.

Şen, S. et al. (2020): Comparison of acupuncture on specific and non-specific points for the treatment of painful temporomandibular disorders: A randomised controlled trial. J Oral Rehabil, 47(7):783-795.

Slade, G.D. et al. (2008): Orthodontic Treatment, Genetic Factors and Risk of Temporomandibular Disorder. Semin Orthod, 14(2):146-156.

Sun, J. et al. (2023): Temporomandibular joint disc repositioning and occlusal splint for adolescents with skeletal class II malocclusion: a single-center, randomized, open-label trial. BMC Oral Health, 23(1):694.

Tecco, S. et al. (2010): Fixed orthodontic therapy in temporomandibular disorder (TMD) treatment: an alternative to intraoral splint. Cranio, 28(1):30-42.

Uzunçıbuk, H. et al. (2024): Prevalence of temporomandibular disorders in clear aligner patients using orthodontic intermaxillary elastics assessed with diagnostic criteria for temporomandibular disorders (DC/TMD) axis II evaluation: A cross-sectional study. J Oral Rehabil, 51(3):500-509.

Walczyńska-Dragon, K. et al. (2014): Correlation between TMD and cervical spine pain and mobility: is the whole body balance TMJ related? Biomed Res Int, 2014:582414.

The changes in the established bony landmarks also differed between the two study groups. Within the occlusal group, worsening of retrusion and deviation of the mandible were noted, whereas in the joint occlusal group, improvements were documented, with effective correction of both retrusion and deviation. Thus, the clinical study demonstrated that in adolescent patients with TMJ ADD and jaw deformities, proceeding with orthodontic treatment without prior disc repositioning surgery carries the risk of condylar resorption, worsening of deformities, and possibly relapse (see summary in Fig. 13). In contrast, performing disc repositioning prior to orthodontic treatment promotes condylar regeneration, thereby improving deformities and increasing treatment stability.

Guideline(s)

The following excerpt is based on the Guidelines for Diagnosis and Management of Disorders Involving the Temporomandibular Joint and Related Musculoskeletal Structures approved by the *American Society of Temporomandibular Joint Surgeons* **published** in 2003. The focus in this summary lies mainly on treatment. Other chapters are not presented or massively shortened. This guideline focuses on the disc displacement, which is an internal derangement (ID), and the usual coexisting osteoarthritis (OA), for the reason that ID/OA is considered to be the most common cause of serious TMJ pain and dysfunction and therefore the most likely to be treated surgically.

Evaluation and Diagnosis

A detailed history, head and neck evaluation, and general physical examination when indicated, is essential. Imaging of TMJ is necessary to establish the presence of pathology and stage of disease (see Table 2) to select proper therapy. Bilateral imaging is recommended because of high incidence of bilateral disease. Basic screening radiographs should be used to demonstrate temporal bone and condylar morphology. The disc and associated soft tissue structures should also be imaged mainly by MRI or in selected cases by arthrography.

Guidelines for non-surgical treatment

Non-surgical treatment should be considered for all symptomatic patients with ID/OA. For mild or moderate pain and dysfunction, this often is sufficient. One or more of the following non-surgical treatment modalities may be utilized:

- **Diet**:

Load reduction can be achieved to reduce joint loading from forces of mastication - non chewing diet with liquids or pureed food.

- **Pharmacologic agents**:

Nonsteroidal anti-inflammatory drugs (NSAID) is the mainstay as inflammation is a prominent feature. Low dose tricyclics are effective in controlling pain from nighttime bruxism. After psychiatric consultation, antidepressant medication can be helpful as adjunct. Prolonged use of otranquilizers, muscle relaxants, sedatives, and narcotics are seldom indicated. Narcotic pain medications are used for a short period after surgery.

- **Maxillomandibular Appliances:**

occlusal splints, orthotics, night guards, bite guards are widely used for bruxism control. **Prolonged** use of repositioning appliances for ID/OA can cause **undesirable** and irreversible changes in dental occlusion, skeletal structure, and muscle dynamics! Other dental treatments, such as occlusal equilibrations, extensive dental restoration, or orthodontic treatment are not indicated as the primary treatment for ID/OA.

- **Physical Therapy (PT)**:

PT in conjunction with other methods is used to relieve musculoskeletal pain and improve range of motion.

- **Injections:**

Injections of tender muscles, trigger areas, and/or joint spaces with local anesthetic solution is used for diagnosis and relief of symptoms. Corticosteroid injection can be effective in reducing capsulitis. The use of Botox to eliminate muscle spasm and reduce strength of contraction, while retaining voluntary control, has allowed this drug to be used in a variety of clinical conditions involving muscle hyperactivity. It appears to be an effective method for treating severe bruxism when traditional methods fail, as well as cases of masseteric hypertrophy.

- **Behavior Modification**

Behavior modification is intended to help patients understand and avoid stress-related lifestyle habits, such as clenching, bruxism, and excessive gum chewing. Psychological consultation may be indicated for stress management.

Guidelines for surgical treatment

Surgery for treatment ID/OA has the twin advantages of effectiveness and a rapid response. Surgical consultation should be offered within 2-3 weeks to patients with documented ID/OA and in whom severe pain and dysfunction persists after a trial of non-surgical therapy. Early surgical consultation is especially important in cases of closed lock where delay in treatment can accelerate the progression of ID/OA.

The following procedures are accepted for treatment of ID/OA:

- Arthrocentesis
- Arthroscopy
- Condylotomy (indirect arthroplasty)
- Arthrotomy

Alloplastic implants are not generally indicated for initial surgical treatment of joints with ID/OA. Prosthetic joint replacement may be indicated in selected patients with severe joint degeneration, destruction, or ankylosis.

- Other Procedures

a. Coronoidotomy/coronoidectomy
b. Styloidectomy (Eagle's Syndrome)
c. Procedures for Recurrent Dislocation

Postoperative care: Patient instruction should include: wound care, thermal applications (ice, heat), non-chew diet regimen, medications, occlusal management, bruxism control, joint motion plans. Active or passive joint exercise is a **key component** of management after surgery. Long-term follow up is recommended.

Table 2 – Staging of Internal Derangement of TMJ (extracted from cited guideline)

Stage	Clinical	Imaging	Surgical
I. EARLY	painless clicking No restricted motion	Slightly forward disc, Reducing normal osseous contours	Normal disc form Slight anterior displacement Passive incoordination (clicking)
II. EARLY /INTERMEDIATE	Occasional painful clicking intermittent locking, headaches	Slightly forward disc, Reducing early disc deformity Normal osseous contours	Anterior disc displacement Thickened disc
III. INTERMEDIATE	Frequent pain Joint tenderness, Headaches Locking, Restricted motion Painful chewing	Anterior disc displacement, reducing early progressing to non-reducing late Moderate to marked disc thickening Normal osseous contours	Disc deformed & displaced Variable adhesions No bone change
IV. INTERMEDIATE/LATE	Chronic pain, headache Restricted motion	Anterior disc displacement, non-reducing Marked disc thickening Abnormal bone contours	Degenerative remodeling of bony surfaces Osteophytes,Adhesions, Deformed disc without perforation
V. LATE	Variable pain Joint crepitus Painful function	Anterior disc displacement, non-reducing with perforation and gross disc deformity Degenerative osseous changes	Gross degenerative changes of disc and hard tissues; Perforation Multiple adhesions

Practical exercises

Homework program for relaxation of the jaw

Temporomandibular joint disorders are also becoming increasingly common in adolescents and young adults. This may be because psychological stimuli such as hearing, seeing and smelling are transmitted to the masticatory center via nerves I, II and VIII, as is all information from the temporomandibular joints, teeth and muscles (Fig. 9). From there, the various muscle groups are then influenced, which can lead to tension and pain. To relax tense chewing muscles, there are a few simple exercises that anyone can do at home.

1) Mouth opening

Stand up straight! Open and close your mouth in front of the mirror. Slowly move your lower jaw straight up and down.

2) Jaw stretching

First massage the jaw on the right and left with your fingertips using small circular movements.
Then open your mouth as wide as possible ("yawn forcefully") and hold the tension for about 10 seconds, then relax your jaw again.

Fig. 14: *Exercise 2 - wide opening of the mouth (photo: C. Keil)*

3) Jaw resistance

Press against the chin with one hand; push the chin straight forward against the resistance of the hand (Fig. 15) and hold the tension for 10 seconds (also possible in a sideways movement).

Fig. 15: *Exercise 3 - jaw resistance (photo: C. Keil)*

4) Jaw acupressure

Place the middle fingers in the small indentation next to the earlobe (beginning of the jaw joint) and press this point for 15-30 seconds. Then release the tension.

Repeat all exercises several times a day 3-5 times!

Related products

As already stated in the guidelines, non-surgical treatment of CMD is indicated as a priority. Two commercially available treatment devices are the StressGard occlusal splint (Fig. 16) and the AquaSplint® (Fig. 17). The AquaSplint® is a self-adjusting and prefabricated splint for the treatment of TMDs. Hydrostatic equalization between the water cushions connected by a tube allows pain-relieving harmonization of the craniofacial structures. The AquaSplint can be used for the following indications:

- rapid pain relief and muscle relaxation (immediate treatment)
- simple pre-prosthetic / pre-orthodontic
- pre-orthodontic bite determination
- neutralizes malfunctions, premature contacts, forced bites
- differential diagnostics of the multifactorial etiology of CMD
- supportive therapy for associated disorders such as cervical spine syndrome, tinnitus, migraine, joint trauma, as well as for limitations and blockades

Fig. 16: *Bite splint by TotalGard available from various distributors worldwide*

In case of severe bruxism, the Aquasplit is contraindicated. In this case, StressGard a simple, effective mouth guard can be used. StressGard is ready for immediate use and is designed to prevent teeth grinding and thus tooth, jaw, neck and head pain.

Fig. 17: *Aqua Splint by Sabbagh - distributed in various medical shops.*

Save the date

- 29th **AEEDC Conference**: February 4-6, 2025 | Dubai, UAE
- 129th **Annual meeting of the American Association of Orthodontics**: April 25-27, 2025 | Philadelphia, United States
- 100th **European Orthodontic Society Congress:** June 2-6, 2025 | Krakow, Poland
- **FDI World dental congress**: September 9-12, 2025 | Shanghai, China

Impressum: MIB Medizin, Information & Beratung GmbH
Gartenstraße 21, 48147 Münster
Deutschland
Phone: +49 (0)251 28 76 99 90
Director: Prof. Dr. Dr. Dr. h. c. mult. Ulrich K. Joos
USt-ID: DE 213825331
AG Münster, HRB 6055

contact: info@imc-orec.de