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EDITOR

ASSOC. PROF. DR. NESLİHAN YILMAZ ÇIRAKOĞLU

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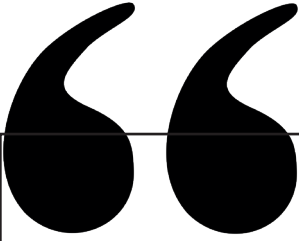
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# Chapter 1

## **CONSERVATIVE OCCLUSAL MANAGEMENT OF TEMPOROMANDIBULAR DISORDERS**

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Since the etiology of temporomandibular (TM) disorders is multifactorial and it is not fully known which signs and symptoms will cause more serious problems in the future, it is generally desired that the initial treatments are irreversible. A multidisciplinary approach is required in the conservative treatment of TM disorders (Ardic F et al. 2006; Atsu SS Ayhan-Ardic F, 2006; Okeson JP, 2020). Considering the etiological factors, the patients are informed about the disorder in terms of treatments such as drug therapy, physical therapy, intraoral interocclusal splints (appliance) and occlusion adjustment. The aim of the treatment of TM disorders is similar to the treatment of other orthopedic disorders, to reduce pain, improve function, reduce overloading of the temporomandibular joint (TMJ) region and chewing muscles, and ensure normal daily activities (Kandasamy S, Rinchuse DJ, Greene CS. & Johnston LE Jr, 2022; Zhang SH. et al, 2020). It should not be forgotten that the musculoskeletal system has a natural healing capacity in conservative treatment. Although the treatment of simple TM disorders is relatively easy, the treatment of chronic, complex TM disorders requires the assistance of more than one specialist physician, especially if psychological factors are a factor in the etiology (Cleland J & Palmer J, 2004; Kandasamy S, Rinchuse DJ, Greene CS. & Johnston LE Jr. (2022). Okeson JP, 2020; Michelotti A, de Wijer A, Steenks M & Farella M, 2005; Miyake R, Ohkubo R, Takehara J & Morita M 2004; Thomas DC, Singer SR. & Markman S, 2023).

Conservative treatment of temporomandibular disorders can be classified as follows:

1. Temporary occlusal treatment
  - Occlusal splints (occlusal appliance)
2. Permanent occlusal treatment
  - Orthodontic treatment
  - Selective grinding
  - Prosthetic treatment
3. Collateral treatment
  - Biofeedback
  - Exercises
  - Heat therapy
  - Electrical stimulation
  - Drug therapy



## 1. Temporary occlusal treatment

Since the etiology and the relationship between many TM disorders are complex, it is desired that the initial treatments are temporary (Atsü SS, Tekdemir I & Elhan A, 2006; Velly AM, Gornitsky M & Philippe P, 2003; Yap AUJ, Tan KBC, Chua EK & Tan HH, 2002; Yun PY & Kim YK, 2005). Temporary occlusal treatment changes the patient's occlusal condition reversibly through occlusal splints. Occlusal splints also gain importance in terms of diagnosis by allowing the elimination of etiological factors. It is stated that these splints show a clinical success rate of 70-90% (Okeson JP, 2020). The success or failure of occlusal splints depends on the choice of splint, the manufacturing technique, its adaptation to the patient and the cooperation with the patient. The important criterion in the selection of occlusal splints is the elimination of the etiological factor. Therefore, a good anamnesis, clinical examination and the correct diagnosis are very important. Although there are different types of occlusal splints, the most commonly used are stabilization and anterior positioning occlusal splints (Atsu SS & Ayhan-Ardic F, 2006; Jokstad A, Mo A & Krogstad BS, 2005; Okeson JP, 2020).

**Stabilization splints:** These splints ensure that the temporomandibular joint remains in a more stable or functional position by the forces on the teeth and joint are distributed, the masticatory muscles are relaxed and the teeth are protected from the effects of bruxism (Al-Ani Z, Gray RJ, Davies SJ, Sloan P & Glenn AM, 2005; Okeson JP, 2020). Since stabilization splints are also used to reduce muscle hyperactivity, they are also called muscle relaxing (myorelaxant) splints. Stabilization splints are made in a centric relation position of the mandible and in a way that the occlusal relation is optimum for the patient. The adaptation of the splints is important in eliminating premature contacts and ensuring optimum occlusion at the same time while the condyle is in the most stable position according to the musculoskeletal system (Atsü SS, Tekdemir I & Elhan A, 2006; Okeson JP, 2020). During adaptation, the posterior teeth should be disclosed under the guidance of the canine guide. Correct adaptation phase is great importance for the success of the treatment. It is often applied to the upper jaw in a way that covers the entire arch. Although it can also be applied to the lower jaw, it is preferred to be applied to the upper jaw because the upper jaw is more stable, contains more retentive space than the lower jaw, and the desired contacts in all skeletal (Class II and III). When the splints do not cover the entire arch and are used uncontrolled for a long time, complications can be seen in the chewing system with occlusion disorders (Magnusson T, Adiels AM, Nilsson HL & Helkimo M, 2004; Okeson JP, 2020; Turp JC, Komine F & Hugger A, 2004).

The main purpose of these splints is the treatment of muscle hyperactivity (Zhang SH. et al., 2020). Studies show that they also reduce parafunctional activities frequently seen with stress. Stabilization splints are often used in

cases such as muscle hyperactivity, myospasm, myositis and bruxism. Clear (transparent) hard acrylics can be used as construction materials, as well as vacuum-formed materials, and the occlusion can be created with hard acrylic material (Turp JC, Komine F & Hugger A, 2004). The splint should be able to be passively placed and removed without applying force to the teeth. A well-adapted splint should be in equal contact with all teeth on a flat splint surface in centric relation and centric occlusion, and canine guidance should be provided in eccentric movements. If eccentric movements cannot be made comfortably under canine guidance, this may cause an increase in symptoms related to muscle discomfort (Okeson JP, 2020; Wassell RW, Adams N & Kelly PJ, 2004) (Figure 1).

Stabilization splints can be prepared from hard acrylic or they can be prepared from silicone-based material by vacuum forming. The area of use of soft splints is less than hard splints. The effects of hard and soft appliances on muscle activity were compared by using EMG, it was found that splints made of hard acrylic were more effective in reducing muscle activity than soft splints (Okeson JP, 2020). However, in their literature review, Turp et al. (2004) found that there was no difference between hard and soft splints in terms of the treatment of myofascial pain disorders. Soft splints can be used for initial treatment in cases of retrodiscitis, capsulitis or when patients cannot adapt to hard acrylic material. Another area of use for soft splints is to protect teeth during sports activities (Okeson JP, 2020) (Figure 2).

**Anterior positioning splints:** These splints position the mandible more forward than the centric relation position and provide a more appropriate condyle-disc relation in cases where the disc and condyle are out of harmony. The aim is to provide an optimum condyle-fossa relation and to regain the normal function of the temporomandibular joint (Zhang SH. et al, 2020). In the treatment performed with anterior positioning splints, the position of the mandible is not changed permanently. The aim is to temporarily change the position of the mandible until the appropriate condyle-disc relation is achieved and to provide an environment for the tissue to heal itself in this position (Stiesch-Scholz M, Kempert J, Wolter S, Tschernitschek H & Rossbach A, 2005; Tecco S, Festa F, Salini V, Epifania E & D'Attilio M, 2004; Williamson EH, 2005). When the symptoms subside and function is regained, the occlusal splint is gradually worn down and the inter-arch relation is restored to its former position. These splints are mainly used in the treatment of disc interference disorders. They can also be used in some acute temporomandibular joint pains and articular inflammation cases (such as retrodiscitis, capsulitis). Another area of use is for the treatment of sounds coming from the temporomandibular joint (single or reciprocal clicking) (Tecco S, Festa F, Salini V, Epifania E & D'Attilio M, 2004; Okeson JP, 2020). It is stated that anterior positioning splints reduce the stress on the temporomandibular joint by changing the structural

relationship between the lower and upper jaws and change the localization. In these splints, the mandible is positioned slightly forward of the centric occlusion. This should not exceed 1-2 mm (Okeson JP, 2020; Simmons HC, 2005) (Figure 3). In determining this position, the mandibular position where there is no clicking sound is considered to be the position in which the condylar-disc relationship is optimum. It is also desired that the patient's pain disappears in this position. In some cases, the passing of the clicking sound does not indicate successful reduction of the disc, but it is important in terms of choosing a reference point for treatment. Some researchers have suggested that this position has to be determined by using arthrography or computerized tomography (CT) but also they emphasize the difficulty of determining it and making the appliance. In addition, it should be preferred that the maxilla-mandible relationship determined with anterior positioning splints be as close as possible to the original intercuspal position in order to minimize the irreversible effects of the treatment. During its construction, anterior positioning stops are shaped in the anterior region (right-left canine region) on the splint (Okeson JP, 2020; Simmons HC, 2005). These prevent the mandible from returning to its former position and help it stay more forward than the centric relationship position. While it is preferred to be made on the upper jaw for the reasons mentioned above, the ease of application of the guide ramp to the upper jaw and its greater effectiveness in keeping the mandible forward are other reasons. The construction technique and materials used are the same as the stabilization splint. In order to make a successful anterior positioning splint, it is important to determine the correct anterior position (Kurita H, Ohtsuka A, Kurashina K & Kopp S, 2001; Okeson JP, 2020).

The most effective use period for anterior positioning splints is 2-4 months. It can be recommended to use it only at night, but it should be used for almost 24 hours, especially in acute cases. Studies show that anterior positioning splints are more effective in the short term than stabilization splints in the treatment of disc interference disorders. Correct diagnosis is very important in determining the treatment. If the applied appliance does not reduce the signs and symptoms, it may be an indication that the diagnosis or the splints are not made appropriately (Okeson JP, 2020; Stiesch-Scholz M, Kempert J, Wolter S, Tschernitschek H & Rossbach A, 2005). The patient's age and health status are factors that affect the success of the treatment. The temporomandibular joint is a tissue that heals slowly. Healing is faster in young patients than in older patients. Systemic diseases of the patient such as diabetes and rheumatoid arthritis are also factors that delay healing. If macrotrauma is the etiological factor, starting treatment immediately after the trauma is important in terms of the effectiveness of the treatment and shortening its duration. If the symptoms return after treatment, it means that the intracapsular tissues have not healed or adapted sufficiently. After treatment, the anterior positioning

splint should be grinding every 2-3 weeks and the mandible should be moved back approximately 1-2 mm (Okeson JP, 2020; Williamson EH, 2005). This procedure repeated until it reaches a stable musculoskeletal position. If the mandible returns to the intercuspal position without any disturbance in occlusion after treatment, there is no need for any occlusal treatment. On the other hand, if the disc interference disorder is caused by occlusion, when the mandible closes in the superior anterior position, the initial contacts on the teeth are not close to the intercuspal position. In this case, the superior-anterior position in the fossa, which is the stable position for the condyle, is not compatible with the intercuspal position of the teeth and requires occlusal rehabilitation as a result of splint treatment. If the malocclusion is not corrected, the patient will return to the old occlusal position and the signs and symptoms of disc interference disorder will recur (McNamara JA Jr, Seligman D & Okeson JP, 1995; Okeson JP, 2020; Seligman DA & Pullinger AG, 1991).

Sometimes, since the healing or adaptation of the retrodiscal tissues is not completed with the withdrawal of the anterior positioning splint, the symptoms will return and in this case, the following applications can be made: The mandible is returned to the anterior position, that is, the position where there are no symptoms, and the occlusion is reshaped according to this position with orthodontic treatment, full mouth restorations or orthognathic surgery (Kandasamy S, Rinchuse DJ, Greene CS. & Johnston LE Jr, 2022; Thomas DC, Singer SR. & Markman S, 2023). Since these options require a major change for the entire stomatognathic system, all conservative techniques should be tried before complex treatment methods. Another approach is to apply the treatment for a longer period of time from the beginning, considering that the time required for adaptation and healing of the tissues varies from patient to patient when using an anterior positioning splint. In many patients, 8-10 weeks is not enough for healing and adaptation of the tissues. This approach is a treatment approach that should definitely be tried before surgery and full mouth rehabilitation (Okeson JP, 2020).

Stabilization and anterior positioning splint types should be used according to the patient's diagnosis. While it can be used all day in acute painful positions, it should be preferred to be used at night while sleeping according to the sign and symptoms. Long-term use of it may cause difficulty of speaking and disturbed the occlusion. It is also appropriate to use splints at night in patients with bruxism (Okeson JP, 2020, Simmons HC, 2005; Tecco S, Festa F, Salini V, Epifania E & D'Attilio M, 2004). Although stabilization and anterior positioning splints are frequently used in temporomandibular disorders, pivot, anterior bite plate, posterior bite plate and NTI (nociceptive trigeminal inhibition) splints can also be used in different temporomandibular disorders (Magnusson T, Adiels AM, Nilsson HL & Helkimo M, 2004; Okeson JP, 2020) (Figure 4). Stiesch-Scholz et al. (2005) compared stabilization splints

with pivot splints in cases with non-reduction disc displacement and found no statistical difference between visual analog scale (VAS) and maximum mouth opening at the end of 3 months. In a study conducted by Tecco et al. (2004) on 40 patients with internal derangements, the effectiveness of anterior positioning and stabilization splints on pain intensity and joint noise was compared. The study found that anterior positioning splints were more effective in reducing pain, while there was no significant difference between splint types in reducing joint noise. In another study, Magnusson et al. (2004) compared stabilization splints with NTI splints and showed that stabilization splints were more effective in relieving temporomandibular disorders. When the literature is reviewed, the reasons for the different results regarding splint treatment can be explained as follows: small number of subjects, non-random selection of subjects, insufficient number of control groups, difficulty in creating specific patient groups due to the complex etiology of temporomandibular disorders, and differences in the adaptation capacities of patients (McNeill C, 1997; Okeson JP, 2020).

## 2. Permanent occlusal treatment

Occlusion modification may be necessary, especially if the cause of TM disorders is premature contact and/or non-suitable restorations (Thomas DC, Singer SR. & Markman S, 2023). The individual's neuromuscular adaptation capacity becomes important in this case. While many occlusal factors may not cause TM disorders, TM disorders signs and symptoms are observed in cases where the individual's neuromuscular adaptation capacity and structural tolerance are exceeded (Okeson JP, 2020). Occlusion is a risk factor that contributes to the development of TM disorders. Although some studies have not found a direct relationship between occlusion and TM disorders, it should be taken into consideration that some factors cannot be eliminated clinically and that a cause-and-effect relationship cannot be fully understood between the investigated parameters (Thomas DC, Singer SR. & Markman S, 2023). However, it is stated that increased open bite (6 mm), overjet greater than 6-7 mm, difference or discrepancy between centric relation and centric occlusion greater than 2 mm, total and partial dentures with excessively high or low vertical dimensions and high restorations may affect the disorders (Velly AM, Gornitsky M & Philippe P, 2003). When occlusal therapy is necessary for the treatment of the patient's TM disorders, the patient's pain should be relieved with occlusal splints first and the mandibular movement limits should be provided as much as possible. The occlusal splints may also be used for a kind of diagnostic purpose. During occlusal treatment, in addition to classical occlusion information, occlusal rehabilitation should be performed by fulfilling the structural and physiological requirements of the patient's chewing system (Turp JC, Komine F & Hugger A, 2004).

**Selective Grinding:** Generally, selective grinding is a type of treatment

performed when the patient's vertical dimension and intercuspal position are suitable. In the treatment, the patients' lower and upper jaw models are examined by taking them to a fully adjustable or semi-adjustable articulator and determining the necessary abrasion points, and this is applied to the patient's mouth with precision. The occlusal plane should be suitable for the patient's chewing system and should reduce signs and symptoms of TM disorders (Koh H & Robinson PG, 2004; Okeson JP, 2020).

Selective grinding can be done in the following order:

- 1) Elimination of tooth surfaces that prevent occlusion in the centric relation position,
- 2) Selective grinding of tooth surfaces that interfere with lateral movements,
- 3) Elimination of posterior tooth surfaces that interfere with protrusive movements,
- 4) Adjustment of anterior guidance.

Various colored articulating papers, stone and diamond abrasives, and polishing rubbers can be used during selective grinding. One of the purposes of selective grinding is to ensure that occlusal forces are transmitted along the long axis of the teeth. The BULL rule is followed to eliminate working side conflicts (Buccal upper, lingual lower). Conflicts are eliminated by grinding the buccal cusps in the upper jaw and the lingual cusps in the lower jaw. Mediotrusive side conflicts are resolved by grinding the buccal slopes of the upper lingual cusps and the lingual slopes of the lower buccal cusps. Care should be taken not to grind the cusp tips. This should only be done if necessary by grinding the cusp tips of the teeth in one jaw and the centric relationship should be preserved. However, in order to prevent TM disorders, it is not recommended to eliminate the occlusion disorders with selective grinding before the TM signs and symptoms appear (Koh H, Robinson PG, 2004; Okeson JP, 2020).

**Prosthetic treatment:** If sufficient functional harmony cannot be achieved with selective grinding and the patient's TM disorders signs and symptoms continue or if the intercuspal position (the position where the teeth are in maximum relation to each other) and the vertical dimension need to be changed, the occlusal plane should be recreated with prosthetic restorations (Okeson JP, 2020). The aim of prosthetic treatment is to provide prosthetic relations between the upper and lower jaws in a previously determined position where the patient's pain symptoms have decreased or disappeared. Prosthetic treatments to be performed considering the indication differences are inlay-onlay, crown, bridge, removable partial dentures, total denture or creation of new anterior guidance with composite resins. In cases where the occlusion is to be completely changed in both jaws or one jaw, fixed temporary restorations should be used for a sufficient period of time before permanent

restoration and their compatibility with the patient's chewing system should be checked (Hammad IA, Nassif NJ & Salameh ZA, 2005; Guttal S& Patil NP, 2005; Di Paolo C, Panti F, Crocitto P & De Luca M, 2004; Chacona RL, 2003; Badel T, Kraljevic S, Panduric J & Marotti M, 2004; Thomas DC, Singer SR. & Markman S, 2023).

The aim of all occlusal treatments performed in TM disorders should be as follows;

1) Ideal jaw relationship determined and intercuspal contacts should show maximum symmetrical distribution,

2) There should be axial or near-axial loading on the teeth,

3) There should be an occlusal plan that is specific and acceptable for each individual, 4) Proper contacts should be provided for mediotrusive, laterotrusive and anterior movement.

5) An acceptable vertical dimension should be provided.

**Orthodontic treatment:** In cases where intercuspatation between the jaws cannot be achieved after the use of anterior positioning splints or when it is diagnosed that the TM disorder is caused by occlusion, orthodontic treatment is needed to ensure stability between occlusion and TMJ. Fixed, removable, functional and extraoral appliances can be used in orthodontic treatment (Kandasamy S, Rinchuse DJ, Greene CS. & Johnston LE Jr, 2022; Okeson JP, 2020; Di Paolo C, Panti F, Crocitto P & De Luca M, 2004).

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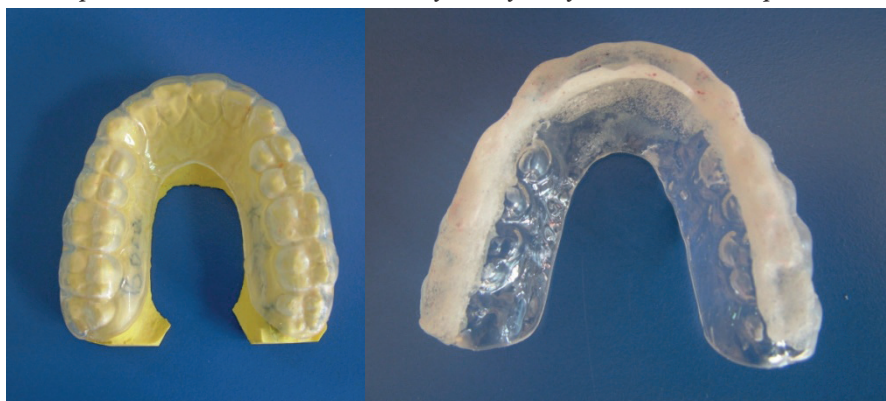
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## Figures



**Figure 1.** *Stabilization (Muscle relaxant) splint. Equal occlusal contacts should be provided in centric relation on the flat surface of the stabilization splint.*



*Figure 2.* *Soft (made of silicone material) splints.*

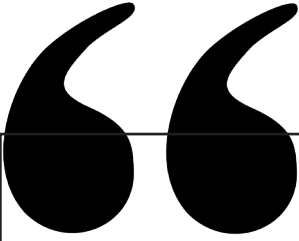


*Figure 3.* *Anterior positioning splint.*



*Figure 4.* *Pivot splints. It is thought that exercises performed with these splints for 5 minutes three times a day create a distraction effect in the TMJ region.*





## Chapter 2

### **ANKYLOGLOSSIA: ETIOLOGY, CLINICAL FINDINGS AND TREATMENT OPTIONS**

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The lingual frenulum is a dense fibrous connective tissue with a multi-layered structure, composed of mucous membranes, fasciae, or upper fibres of the genioglossus muscle. It connects the underside of the tongue to the floor of the mouth and the mandibular bone. Its development begins in the fourth week of pregnancy, when the first, second, and third pharyngeal arches give rise to the tongue. Anatomical differences in these layers can result in an embryological disorder known as ankyloglossia (from the Greek “ankylos” meaning bound, and “glossa” meaning tongue), characterised by a thick and tight frenulum or its placement restricting the mobility of the tongue. Ankyloglossia is most commonly characterised by a heart-shaped tongue or a small notch at the tip of the tongue. (Tomara, Toli, Vasilopoulou, Sarantopoulos, & Papadopoulou, 2023) (Olivi, Signore, Olivi, & Genovese, 2012) (Klockars, & Pitkäranta, 2009a) (Hill, Lee, & Pados 2021) (Reddy, Reddy, Bindu, Ramya, & Ramesh, 2014). Ankyloglossia, a congenital anomaly, can result not only from a short frenulum but also from shortening of the genioglossus muscle, either alone or in conjunction with a short frenulum (Hill, Lee, & Pados, 2021) (Tsaousoglou, Topouzelis, Vouros, & Sculean, 2016).

A panel of ankyloglossia experts in the United States has suggested that while ankyloglossia can lead to functional or behavioral disorders, it can also be considered as an anatomical structure. A lingual frenulum that can be observed or felt by touch from birth up to 6 months is considered normal and commonly seen; therefore, as long as it does not affect function, the lingual frenulum should not be considered ankyloglossia (Salt, Mehendale, Dhanda, & Khemani, 2020).

Ankyloglossia can affect many aspects of a child’s life, and it may therefore be helpful to involve professionals from various specialties in clinical practice and management. It would be remiss of me not to mention the invaluable input of other professionals, including otolaryngologists, paediatricians, speech therapists, paediatric surgeons, lactation consultants, dentists and orthodontists. Each of these professionals approaches ankyloglossia from a unique perspective. The literature on ankyloglossia contains a variety of opinions, which is understandable given the diversity of perspectives involved. (Tomara, Toli, Vasilopoulou, Sarantopoulos, & Papadopoulou, 2023).

### **Etiology and Hereditary Transmission of Ankyloglossia**

It seems that there may be some evidence indicating that ankyloglossia might be a genetically transmitted pathology. However, it is not yet clear what the specific genetic components are that regulate the phenotype and penetration in affected patients. Further research would be beneficial to clarify the precise etiopathogenesis of ankyloglossia. (Reddy et al., 2014). Ankyloglossia can present as an isolated anomaly or in conjunction with other craniofacial anomalies. It has been reported that 82% of ankyloglossia

cases appear as isolated anomalies without other associated anomalies or diseases. Nevertheless, some studies have indicated that this condition may be linked to syndromes associated with the X chromosome, including cleft palate syndrome, Ehlers-Danlos syndrome, inverse epidermolysis bullosa, Smith-Lemli-Opitz syndrome, Kindler syndrome, Beckwith-Wiedemann syndrome, Van der Woude syndrome, Simpson-Golabi-Behmel syndrome and Opitz syndrome. It has been suggested that ankyloglossia may potentially result from mutations in T-box genes or exposure to teratogenic substances during pregnancy. A significant portion of ankyloglossia is hereditary, showing particularly autosomal dominant traits. There are two reports that isolated ankyloglossia is hereditary as an autosomal dominant trait. Additionally, studies have indicated that cocaine use by the mother during pregnancy can increase the risk of ankyloglossia in the baby by more than three times (Tsaousoglou et al., 2016) (Harris, Friend, & Tolley, 1992) (Costa-Romero, Rivero-Calle, & Martín-Torres, 2021).

### **Classification of Ankyloglossia**

There is no single standardized diagnostic grading system for defining ankyloglossia (Klockars, & Pitkäranta, 2009a). A few studies have proposed classification standards for ankyloglossia using anatomical and/or functional criteria, but these standards vary in their measurements (Ruffoli, 2005). The term “free tongue distance” refers to the space between the attachment of the lingual frenulum at the base of the tongue and the tip of the tongue. A clinically acceptable normal free tongue distance is greater than 16 mm. Based on Kotlow’s observations, ankyloglossia can be classified into four types, each defined by the clinical length of the free tongue, which is the distance the tongue can be extended outward. Kotlow’s Classification of Ankyloglossia: (Kotlow, 1999).

- Class I: Mild ankyloglossia (12-16 mm)
- Class II: Moderate ankyloglossia (8-11 mm)
- Class III: Severe ankyloglossia (3-7 mm)
- Class IV: Complete ankyloglossia (<3 mm).

In addition to Kotlow’s classification, there are a number of other tools for assessing ankyloglossia, including the Hazelbaker Assessment Tool for Lingual Frenulum Function (HATLFF), the Bristol Tongue Assessment Tool (BTAT), which has since been renamed TABBY (Tongue-tie and Breastfed Baby), and the Coryllos classification. A systematic review conducted in 2022 revealed that the HATLFF and Coryllos classifications are widely used. However, data from the HATLFF classification is not publicly accessible, while the Coryllos classification criteria are shown below: (Coryllos, Genna, & Salloum, 2004).

Type 1: The frenulum attaches at the tip of the tongue.

Type 2: The frenulum attaches 2-4 mm behind the tip of the tongue.

Type 3: The frenulum attaches at the mid-tongue.

Type 4: The frenulum attaches at the base of the tongue.

### **Incidence of Ankyloglossia**

Ankyloglossia is an anatomical malformation that is more prevalent in males than in females, with a ratio of approximately 3:1. This is primarily due to X-linked genetic traits caused by mutations in the TBX22 gene (Gonzalez Garrido, Andreu, & Vazquez, 2022) (Klockars, & Pitkäranta, 2009b). The prevalence of ankyloglossia has not been precisely determined and is reported in various studies to range from as low as 0.3% to as high as 16%. It would appear that the prevalence is higher in studies investigating newborns (2% to 10%) compared to those examining children, adolescents, or adults (0.1% to 2.08%). Ankyloglossia is more commonly seen as an isolated condition in newborns (Hill et al., 2021), Reddy et al., 2014) (Zhao, He, & Wang, 2022) (Mezzapesa, Fiorella, Del Vecchio, Parisi, & Vicenti, 2020).

In recent years, the number of patients diagnosed with ankyloglossia has risen. This increase can be attributed to several factors. Firstly, there has been a heightened emphasis on the benefits of breastfeeding. Secondly, there has been greater awareness of the negative impact ankyloglossia can have on breastfeeding. Thirdly, there has been an increase in the number of social media and website content about tongue-ties. Fourthly, there has been a growing number of lactation consultants who can identify potential cases. Fifthly, there has been an increase in the number of medical professionals, particularly dentists, who treat ankyloglossia. (Messner et al., 2020).

### **Functional Problems Related to Ankyloglossia**

Ankyloglossia can be observed in individuals ranging from newborns to infants, children, and adolescents. However, in some people, it may go undiagnosed despite causing anatomical or functional problems. Depending on the severity of ankyloglossia, it may be asymptomatic; it can regress spontaneously with development, or individuals affected by ankyloglossia may learn to adequately compensate for the reduced mobility of the tongue over time (Reddy et al., 2014). Ankyloglossia can cause issues in various functions such as sucking, swallowing, chewing, and speaking. It can also lead to mechanical problems (such as difficulty licking lips, licking an ice cream cone, or playing a wind instrument), orthodontic and orthopedic anomalies, and issues related to joint movements. Therefore, particularly at birth or during early childhood, whether or not there are restrictions in tongue movements, early detection of a thick or very tight frenulum is crucial (Tomara et al., 2023) (Tsaousoglou et al., 2016) (Mezzapesa et al., 2020).



There are numerous studies in the literature examining the relationship between ankyloglossia and breastfeeding difficulties. These studies indicate that babies with ankyloglossia often have problems such as difficulty latching onto the nipple, which can lead to persistent issues for nursing mothers, including prolonged nipple pain or conditions like mastitis. It has been observed that continuous nipple pain in women breastfeeding babies with ankyloglossia can occur at rates ranging from 36% to 80% (Hill et al., 2021) (Tsaousoglou et al., 2016)

Costa-Romero and colleagues (2021) in their review reported that babies with moderate ankyloglossia, which does not severely affect tongue movements, can compensate for this condition and improve their sucking skills (Costa-Romero et al., 2021). Campanha et al. have stated that newborns with ankyloglossia are more likely to encounter breastfeeding difficulties, particularly in terms of sucking skills, with a probability as high as 36.07% (Campanha, Martinelli, & Palhares, 2019). Risken and colleagues emphasized that babies with ankyloglossia, regardless of whether the lingual frenulum is anterior or posterior, are more likely to experience breastfeeding difficulties in the first 30 days of life (Riskin et al., 2014). Other studies on breastfeeding have argued that ankyloglossia rarely or never impedes feeding. Messner and colleagues have observed that professionals who hold this view are usually pediatric specialists and otolaryngologists (Messner, Lalakea, Aby, Macmahon, & Bair, 2000).

Prior to the decision to proceed with surgical intervention for ankyloglossia-related breastfeeding difficulties, it is essential to exclude other anomalies that could also be the cause of such difficulties. In particular, comprehensive intraoral examinations, including the assessment of tongue function, should be conducted in newborns presenting with sucking difficulties. (Rowan-Legg, 2015). During this examination, it is of great importance to allow the infant to suck on the gloved finger of the examiner, as this allows for the assessment of tongue movement and function, as well as the checking of the shape and position of the movement. Additionally, palpating the lingual frenulum, observing its flexibility and tissue length, and examining the relationship of the frenulum to the tongue and floor of the mouth are necessary for diagnosis. Furthermore, health professionals should assess the range of tongue elevation relative to the floor of the mouth during an oral examination. Variations in the length, position, and flexibility of the lingual frenulum can affect a baby's ability to suck, and thus, should be considered. Following a detailed intraoral examination, a discussion should be held with the mother about breastfeeding (nipple pain, mastitis, etc.) and any observed feeding issues. Should difficulties be identified, it is recommended that a referral be made to a health professional with expertise in breastfeeding support. (Tomara et al., 2021) (Rowan-Legg, 2015). Despite these efforts, if complaints persist, lingual

frenotomy is recommended. The benefits after frenotomy reported include better nipple grasp by the baby, resulting in reduced nipple pain for the mother and the continuation of breastfeeding practices without interruption (Olivi et al., 2012) (Martinelli, Marchesan, Lauris, Honório, & Gusmão, 2015).

Beyond breastfeeding difficulties, it is suggested that ankyloglossia may lead to respiratory issues in later years due to the forward displacement of the epiglottis and larynx (Tsaousoglou et al., 2016). The tongue is a fundamental organ for swallowing, and a short lingual frenulum can hinder its proper function. Swallowing involves complex neuromuscular activity, starting with the advancement of the tongue's apex to the retroincisal-palatal point, followed by the mid-posterior part of the tongue making contact with the hard and then the soft palate. Everyone with ankyloglossia experiences some degree of difficulty in swallowing because a tongue with ankyloglossia cannot fully perform the movements described above. The inability to elevate the tongue against the palatal tissue prevents the development of adult-type swallowing and perpetuates infantile swallowing patterns, which can lead to an open bite over time. One of the symptoms is a tendency towards mouth breathing due to an open bite. The absence of upward and backward movement of the tongue can result in excessive pressure being exerted on the anterior part of the mandible, which may subsequently lead to mandibular prognathism and the formation of a diastema between the lower incisor teeth. (Olivi et al., 2012) (Reddy et al., 2014).

While most discussions about feeding difficulties related to ankyloglossia focus on breastfeeding, a study involving 37 children with ankyloglossia reported that surgical intervention to correct the tongue-tie improved their feeding skills by 83% (Baxter, Merkel-Walsh, Baxter, Lashley, & Rendell, 2020). The challenges in feeding include increased oral transit time for food, reduced bolus mobility within the mouth, choking, gagging, involuntary expulsion of food during chewing, frustration related to eating, and selectivity in diet (Baxter, Merkel-Walsh, Baxter, Lashley, & Rendell, 2020) (Merkel-Walsh, & Overland, 2018) (Bahr, 2018).

In cases of ankyloglossia, while some children are reported to develop normal speech, others are noted to develop speech deficiencies due to articulation errors or difficulties. This discrepancy has led to a lack of consensus among paediatricians regarding the potential impact of ankyloglossia on speech development. A 2016 study by Tsaousoglou and colleagues found that only 23% of paediatricians acknowledged this association (Tsaousoglou et al., 2016). Similarly, a 2022 study by Wang and colleagues reported that only 25% of paediatricians were aware of the potential impact of ankyloglossia on speech development (Wang, Zhao, Liu, Shen, & Wu, 2022). In accordance with the findings of Meissner's research, 71% of young children with ankyloglossia exhibit speech abnormalities associated with limited tongue mobility

(Messner & Lalakea, 2002). The prevalence of speech disorders in individuals with ankyloglossia varies depending on the specialty of the authors reporting such incidences. In children with ankyloglossia, speech problems are typically identified as articulation disorders resulting from restricted tongue tip movement. Speech sounds that can be adversely affected by limited tongue tip mobility include the following: “t, d, n, l, s, r, z, and th.” (Ito, Shimizu, Nakamura, & Yamanaka, 2015).

In the literature, speech problems are the most common reason, accounting for 64%, for surgically correcting the frenulum. Daggumati et al. in their retrospective review found no significant improvement in speech quality after surgical frenulum correction in children with ankyloglossia compared to those who did not receive treatment (Daggumati et al., 2019). In contrast, many studies claim that patients’ speech and articulation improve post-procedure as tongue mobility is enhanced. Due to this discrepancy in the literature, the effect of surgical intervention on speech improvement in patients with ankyloglossia remains controversial and calls for further research (Zhao et al., 2022) (Messner, & Lalakea, 2002) (Walls et al., 2014).

Ankyloglossia has been linked to sleep difficulties and sleep apnea in both children and adults. In individuals with ankyloglossia, the tongue does not make firm contact with the palate, which particularly during sleep can lead to the tongue falling back into the pharynx, restricting or obstructing the airway. A recent systematic review reported that myofunctional therapy could retrain the tongue to properly adhere to the palate and prevent airway blockage. This therapy has been shown to reduce the apnea-hypopnea index (AHI) by 62% in children and by 50% in adults. While myofunctional therapy often assists with sleep difficulties in cases of ankyloglossia, its effectiveness can be limited in severe cases due to insufficient tongue mobility (Camacho et al., 2015).

Ankyloglossia is often associated with a higher and more anterior position of the hyoid bone. This association is due to the hypertonicity of the extrinsic and suprahyoid lingual muscles (attached to the jaw and skull) and consequently results in the tension of the subhyoid muscles, which are connected through the cervical mid-fascia to the sternum, clavicle, scapula, larynx, pericardium, and mediastinum (Olivi et al., 2012).

### **Treatment of Ankyloglossia**

The literature indicates that a short frenulum is not always associated with tightness or fibrosis. In some cases, despite its reduced length, the frenulum allows for normal lingual mobility. Furthermore, the elasticity of the floor of the mouth can mitigate the effects of ankyloglossia and assist in tongue movement. In such cases, surgical intervention is deemed unnecessary and is not recommended. However, if the anomaly is relatively severe, particularly

if it causes breastfeeding problems, early surgical intervention of the short frenulum is recommended. Messner et al., in their study, have reached a consensus that intervention for a baby with symptomatic ankyloglossia should occur within the first month of life (Messner et al., 2020). Supporting Messner et al.'s findings, Emond et al. reported that mothers in the control group could not endure more than five days without medical assistance and supplementation, and they agreed that surgical intervention should ideally take place at an average of 11 days old (ranging from 8-16 days) (Emond et al., 2014). After the surgical procedure, the necessity of prompt speech therapy for the rehabilitation of the lingual muscles is emphasized (Olivi et al., 2012) (Gonzalez Garrido et al., 2022).

<b>Breastfeeding Difficulties</b>
<b>Speech Difficulties</b>
<b>Inability to lick the upper and/or lower lips</b>
<b>Limited ability of the tongue to reach the palatal retroincisal point when the mouth is wide open, and a distorted shape or invagination at the tip of the tongue when extended outside the mouth.</b>

*Table 1: Clinical and Functional Criteria for Surgical Indication of a Short Frenulum (Olivi et al., 2012)*

Regardless of the indications leading to the decision to correct the frenulum surgically, frenotomy is the primary surgical treatment option; surgical interventions can be classified as simple loosening (frenotomy, frenulotomy, or frenectomy) and sutured surgery (frenuloplasty) (Wang et al., 2022). There are also differing opinions regarding the timing of surgical treatment for ankyloglossia. Some researchers argue that surgical intervention should not be performed until the child is older than four years, and then only if there are significant speech problems, while others advocate for completing the intervention between the ages of 4 and 8, noting that a child's speech development is intertwined with auditory functions, linguistic environment, and intellectual growth. It is well known that ages 2 to 5 are a critical period for the development of a child's vocal system. An untreated short or tight lingual frenulum can limit the motor function of the tongue, seriously affecting the growth and development of the lingual system and inevitably leading to permanent speech disorders in children. Therefore, accurate intervention measures and optimal timing are crucial for infants and young children with speech problems caused by ankyloglossia. Consequently, many studies have reached a consensus that the ideal time for surgical intervention for ankyloglossia is during infancy (Zhao et al., 2022) (Berry, Griffiths, & Westcott, 2012) (Buryk, Bloom, & Shope, 2011).

To perform a frenotomy, the baby should be swaddled with the head positioned towards the practitioner. An assistant should gently pull down on the chin to keep the baby's mouth open. The practitioner should lift the tongue with a

grooved director or fingers to better visualize the frenulum. Using iris scissors, a precise incision of about 2 mm should be made in the central mucous membrane, ensuring that the base of the tongue (due to its vascularization) and Wharton's duct are not harmed. After making the incision, pressure should be applied to the area to control bleeding (Costa-Romero et al., 2021). After the frenotomy, there are several recommendations to help reduce the regeneration rate of the tissue. The first is to breastfeed the baby immediately after the frenotomy to help prevent bleeding. Secondly, post-frenotomy exercises should be performed, which involve carefully applying pressure and massaging the parts of the frenulum. Additionally, the functional mobility of the tongue should be enhanced by encouraging the baby to lift the tongue to the palate and move it sideways. It is recommended that these exercises be performed four to six times a day (Tomara et al., 2023). The complication rate following frenotomy is approximately 9%. The most common complications include bleeding (3-5%, depending on the study), recurrence (5%), injury to the lips or salivary glands, infections, damage to the lingual nerve, formation of mucosal retention cysts, pain, and a failure to improve breastfeeding (1.30%). A less frequent but more severe complication is damage to Wharton's duct. Consequently, it is of paramount importance that the procedure be carried out by a trained professional (Costa-Romero et al., 2021). The traditional frenectomy procedure is a surgical operation performed under local anaesthesia, involving precise incisions. In contrast, frenuloplasty entails the complete removal of the frenulum. This procedure is more invasive and complex than a frenotomy and is conducted under general anaesthesia or anaesthesia of the lingual nerve. Both procedures require suturing and demand surgical expertise, particularly skills in working with young patients, which can make traditional frenotomy techniques challenging. Laser technology offers an excellent alternative to traditional frenotomy. It is simple and quick to apply and is generally well-tolerated by patients. Additionally, the procedure requires minimal anaesthesia and usually presents no symptoms post-operation. Various wavelengths can be utilized in the laser technique, and it is essential to ensure that the energy applied is at the lowest and most effective level possible. Lower energy application minimizes damage to the targeted tissue and promotes a faster healing process. The Er-YAG laser is often preferred for this procedure (Olivi et al., 2012) (Costa-Romero et al., 2021).

It is imperative that appropriate analgesia be provided for surgical interventions. However, comprehensive data on effective analgesia is lacking in the literature. Case reports have indicated the use of acetaminophen, lidocaine, and sucrose for analgesia, yet none of these have been subjected to comprehensive study. Among anesthetic preparations, benzocaine has been subjected to a randomized controlled trial, which demonstrated that it is ineffective when compared to a placebo. (Olivi et al., 2012).

In patients with ankyloglossia, physical therapy is recommended both before and after surgery to improve prognosis. Techniques used include speech exercises, awareness of oral cavity morphology, stretching exercises, and myofunctional therapy that includes extra-buccal and intra-buccal massages. It is also noted that myofunctional therapy can lead to the release of the tongue tie through intraoral and extraoral stimulation without the need for surgical intervention (Gonzalez Garrido et al., 2022).

### **Conclusion**

In conclusion, ankyloglossia is an anatomical disorder that can affect individuals from newborns to adults, but the existing published studies on ankyloglossia are controversial in many aspects. This underscores the importance of comprehensive research, as well as educational and training programs, for lactating mothers, babies with tongue-ties, and professionals who support individuals with ankyloglossia.

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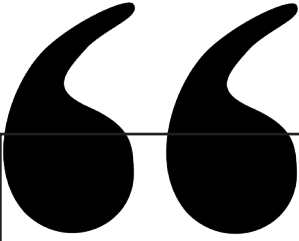
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## Chapter 3

### **MANANGEMENT OF TEMPOROMANDIBULAR DISORDERS**

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Management of temporomandibular disorders (TM) is generally be classified into 2 types as primary treatment and supportive treatment. While the primary treatment is aimed at controlling or eliminating the etiological factor that causes the disorder, supportive treatment is aimed at reducing the patient's symptoms (Okeson JP, 2020).

### I. Disorders of the Masticatory Muscles

A common complaint in patients with masticatory muscle disorders is muscle pain (myalgia). There may be a restriction in mandibular movements due to pain. The anamnesis taken from the patient is important in determining the patient's treatment plan. This disorder can be classified into 4 subgroups and their treatments are listed below (Garstka AA, et al. 2023; Okeson JP, 2020).

- Muscle hyperactivity

*The primary treatment:* The etiology of this disorder can be long-lasting dental treatments or a sudden injury caused by any trauma. the patient's signs and symptoms will disappear with the elimination of the trauma. Other treatment is not needed. If the cause is an inappropriate restoration (a high crown or filling), the patient's symptoms will disappear by correcting the restoration and making it compatible with the current occlusion (Beaumont S, Garg K, Gokhale A. & Heaphy N, 2020; Thomas DC, Singer SR. & Markman S, 2023).

*Supportive therapy:* The patient is advised to limit jaw movements without pain and to eat soft foods. Depending on the severity of the pain, muscle relaxants may be given to the patient (Okeson JP, 2020).

- Myospasm:

*The main treatment:* The cause of myospasm may be the factor causing muscle hyperactivity. If this is not eliminated, the event may turn into myospasm after 2-3 days. Increased psychological stress or deep pain may cause myospasm with a central stimulating effect. The origin of deep pain may be the temporomandibular joint or teeth, as well as cervical pain. The pain from these sources occurs as pain reflected in the chewing muscles (Okeson JP, 2020). In the treatment, the patient is advised to keep jaw movements within painless limits and to eat soft foods. In addition, the patient is advised to not clench their teeth except function (swallowing and eating). If the patient has bruxism, stabilization (muscle relaxing) splint is applied to ensure equal distribution of the loads in occlusion on the teeth (Al-Ani Z, Gray RJ, Davies SJ, Sloan P. & Glennly AM, 2005). If the source is not in the muscle but pulpal origin and causes secondary myospasm in the masseter muscle, the source should be eliminated with the necessary treatment.

*Supportive treatment:* The most preferred supportive treatment for myospasm is physical therapy (heat applications and gentle massage to the painful muscle area will cause relaxation in the muscles) (Asquini G, Pitance L, Michelotti A. & Falla D, 2022).

- Myositis:

Unlike muscle hyperactivity and myospasm, while the treatment of myospasm takes 7-10 days, the treatment of myositis can take weeks and sometimes months.

*The main treatment:* The patient is advised to limit chewing movements, consume soft foods and, if possible, not to move the jaw lead to pain. Anti-inflammatory drugs and stabilization splint are recommended due to inflammation in the local muscle tissue (Garstka AA, et al. 2023; Atsü SS, Tekdemir I. & Elhan A, 2006).

*Supportive treatment:* After the acute symptoms have subsided, passive stretching movements are used to help gradually activate the muscles. In many cases, heat therapy, which will be applied carefully, will help reduce the symptoms. If pain occurs after heat application or passive exercises, these procedures should be reduced as they can increase the pain (Garstka AA, et al. 2023; Michelotti A, de Wijer A, Steenks M. & Farella M, 2005).

- Myofacial trigger point pain:

Myofascial trigger points originate from local hypersensitive areas within the muscle tissue. These areas or points are overloaded by the muscles, constant deep pain (constant deep pain) or increased psychological stress. Upper respiratory tract infections and viral infections can activate them (Okeson JP, 2020).

*Main treatment:* The most effective treatment for myofascial trigger point pain is stretching the trigger points. The vapocoolant spray is used on the muscle and trigger point and then the muscle is stretched. This spray reduces nerve stimulation in this area and temporarily reduces pain. Another technique is to massage in a way that does not cause pain. Physical therapy and injecting local anesthetic into the trigger point and ensuring muscle stretching are other techniques used (Okeson JP, 2020).

## II. Treatment of Disc Interference Disorders

Disc interference disorders are caused by the disruption of the relationship between the condyle-disc complex and the mandibular fossa. It is characterized by intracapsular symptoms. Many cases are chronic and asymptomatic. Such patients notice their discomfort when warned by their physicians. The treatments for these disorders can be done as follows (Cleland J. & Palmer J, 2004; Okeson JP, 2020).

- Degeneration of the condyle-disc complex:

Degeneration occurs with the extension of the supporting ligaments of the condyle-disc complex and the thinning of the disc. These structural changes allow the disc to move out of its normal relationship with the condyle. The cause is usually trauma, more often microtrauma. The source of microtrauma may be chronic malocclusion, or restorations that may cause muscle hyperactivity, Class II anterior deep bite, overjet greater than 6-7 mm. Degeneration of the condyle-disc complex can be examined under the following 3 headings; Disc displacement, disc dislocation with reduction, and disc dislocation without reduction (Okeson JP, 2020).

*a. Disc displacement and disc dislocation with reduction:* The main purpose in degeneration of the condyle-disc complex is to re-establish the normal condyle-disc relationship. If this is achieved, the symptoms usually resolve. If occlusal factors are the main etiological factor, occlusion rehabilitation is necessary. If occlusion is not the etiological factor, normal condyle-disc relationship should be re-established and sufficient time should be given for the tissues to heal themselves. It is usually difficult to find the exact etiological factor in these disorders. It is required to provide normal condyle-disc relationship, to give sufficient time for the tissues to heal themselves and adapt, and then to reconsider the situation for permanent dental treatment (Kandasamy S, Rinchuse DJ, Greene CS. & Johnston LE Jr, 2022; Manfredini D, Ercoli C, Poggio CE, Carboncini F. & Ferrari M, 2023).

*Main treatment:* Anterior positioning splints, stabilization splints and oral exercises are used to provide optimum condyle-disc relationship (Shimada A. et. al. 2019; Simmons HC, 2005). Systemic diseases of the patient such as diabetes and rheumatoid arthritis are factors that delay healing. If macrotrauma is the etiological factor, it is important to start treatment immediately after the trauma in terms of the effectiveness of the treatment and shortening its duration (Ardıç F, 2006; Atsu SS. & Ayhan-Ardıç F, 2006).

*b. Disc dislocation without reduction:* In the treatment of disc dislocation without reduction, unlike the reduced disc location, the aim is to first move the disc that is anterior to the condyle by manipulation, to slide posteriorly and to capture (recapture) it on the condyle side. While performing these procedures, the superior lateral pterygoid muscle and the masseter muscle should not be contracted. If necessary, a local anesthetic can be injected into the superior lateral pterygoid muscle to relax it (Poluha RL et al. 2019; Okeson JP, 2020).

*Main treatment:* First, functional manipulation should be performed to reduce the disc or to have the condyle capture the disc (Nagata K. et. al. 2019). In the procedure, the patient is asked to move the mandible as far forward as possible and the jaw is opened. If this fails, the physician grasps the mandible

by placing his thumb at the level of the 2nd molar on the affected side and applies force downward, upward and to the opposite side to ensure that the condyle moves downward and forward in the fossa. When the lateral and anterior movement is completed, the patient is told to stay like this for 20-30 seconds. Then, the patient is asked to move the mandible as far forward as possible and waited for a few seconds. Then the mouth is opened as much as possible. If the disc can be reduced, anterior the positioning splint is performed consecutively and applied to the patient. The subsequent treatment is the same as in the treatment of reduced disc dislocation (Okeson JP, 2020). If the disc cannot be reduced, the muscle-induced overload on the temporomandibular joint is reduced with stabilization splints. This contributes to the reduction of pain by increasing the adaptation of retrodiscal tissues. Anterior positioning and exercise splints can also be used for treatment purposes in this position (Nagata K, et al. 2019; Okeson JP, 2020; Stiesch-Scholz M, Kempert J, Wolter S, Tschernitschek H. & Rossbach A, 2005).

*Supportive treatment:* Supportive treatment in disc interference disorders should aim to eliminate pain and secondary myospasm. In disc dislocations, pain may occur with central stimulating effects. Increased spasm in the mouth-opening muscles increases intra-articular pressure and makes joint movements difficult. Therefore, drug therapy and physical therapy (such as heat, ultrasound) are recommended as supportive treatment (Cleland J. & Palmer J, 2004; Garstka AA, et al. 2023).

- Structural incompatibilities

It originates from structural disorders of the articular surface and prevents normal jaw movements. Structural incompatibilities may be in the form of adhesion and differentiation in form. Sometimes adhesion can be temporary and allow mandibular movements. It is usually associated with bruxism, which causes long-term static loading in the temporomandibular joint. Stabilization splints are used in the treatment of this disorder because they change the relationship here and reduce interarticular pressure. In cases where adhesion is permanent, arthroscopic surgery is indicated (Zhang SH, et al. 2020; Okeson JP, 2020).

*Supportive treatment:* Passive stretching and ultrasound are used as supportive treatment (Michelotti A, de Wijer A, Steenks M. & Farella M, 2005).

- Subluxation:

Subluxation usually originates from the anatomical form of the fossa. In cases where the short slope of the articular eminence in the posterior continues with a straight and long slope in the anterior, the frequency of subluxation increases in individuals.

*Main treatment:* It is surgically change the form of the temporomandibular joint (Tran C, Ghahreman K, Huppa C. & Gallagher JE, 2022).

*Supportive treatment:* Supportive treatment begins with explaining the cause of the patient's discomfort and the ways to protect it. The patient must learn to open his mouth limitedly so that the mandible does not translate. If this situation cannot be resolved by patient control, orthodontic bands are placed on the teeth and mouth movements are restricted intraorally. Such applications can also be made in patients using dentures, or it may be preferred to increase the slope of the eminence surgically (Okeson JP, 2020; Tran C, Ghahreman K, Huppa C. & Gallagher JE, 2022).

### III. Treatment of inflammatory disorders of the temporomandibular joint:

Inflammatory disorders of the temporomandibular joint are characterized by constant pain in the joint area, especially increasing with function. Since the pain is constant, this results in secondary central stimulatory effects such as myospasm and referred pain. They can be examined in 4 groups. These are capsulitis and synovitis, retrodiscitis, degenerative joint diseases and inflammatory arthritis (Atsu SS. & Ayhan-Ardic F, 2006; Okeson JP, 2020).

- Capsulitis (synovitis):

Trauma or other inflammatory disorders often cause capsulitis or synovitis.

*Main treatment:* Since macro trauma is eliminated, it is important in the main treatment not to expose the joint to another trauma (Okeson JP, 2020).

*Supportive treatment:* It is recommended that the patient limit mandibular movements, avoid painful movements and eat soft foods. Thermotherapy and analgesics applied to the joint area reduce pain. Muscle hyperactivity may be seen together with these disorders, in which case the use of a stabilization splint is important for treatment as it will reduce intra-articular pressure and reduce muscle contraction ( Zhang SH, et al. 2020). If the cause of capsulitis or synovitis is secondary inflammation and originates from adjacent tissues, the main treatment begins with the use of appropriate antibiotics. If the cause is arthritic, arthritis is treated. If capsulitis has developed secondary to disc interference disorders, the patient's disc dislocation should be treated (Ardıç F. et al, 2006; Atsu SS. & Ayhan-Ardic F, 2006).

- Retrodiscitis:

The cause is usually trauma. As a result of the trauma, the condyle is pushed posteriorly towards the retrodiscal tissues. The response of the retrodiscal tissues to trauma is usually inflammation, and the retrodiscal tissues push the condyle forward, causing malocclusion (Okeson JP, 2020).



*Main treatment:* Removal of the trauma.

*Supportive treatment:* If the patient does not have acute malocclusion, analgesics are given and the patient is told to eat soft foods and limit jaw movements. Thermotherapy is recommended as it will reduce pain. After the pain decreases, the patient is told to perform normal jaw movements. If acute malocclusion has developed, a stabilization splint should be applied as the contact of the teeth will increase the pain even more. The appliance is regularly worn until the retrodiscal tissues heal (Okeson JP, 2020).

- Degenerative joint diseases and inflammatory arthritis

Retrodiscitis also occurs as a result of intrinsic trauma in retrodiscal tissues when the disc is displaced anteriorly. When the disc is positioned anteriorly, the condyle is positioned more posteriorly and presses on the retrodiscal tissues. In many cases, since the tissues cannot withstand this pressure, inflammation develops in the tissue as a result of trauma (Yun PY & Kim YK, 2005).

*Main treatment:* The aim is to eliminate the trauma again. If the cause of retrodiscitis is anterior displacement or dislocation of the disc, anterior positioning splints are applied to ensure proper condyle-disc relationship. After the pain and other symptoms subside, the splint is worn and the mandible is placed in centric occlusion position (Atsu SS. & Ayhan-Ardic F. (2006).

*Supportive treatment:* The patient should restrict mandibular movements in a way that does not cause pain. Analgesics and thermotherapy may be recommended until the anterior positioning splint shows its effect and reduces the pain.

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