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Different modalities in management of temporomandibuolar joint dislocation: Systematic review

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***Abstract*---**The pathophysiology of mandibular dislocation involves the combination of three factors: loosening of the capsule and the TMJ ligaments, a prominent eminence, and muscular spasm·Initially, loosening of the capsule and ligaments allows the condyle to perform non-physiological and excessive motions, bypassing the articular eminence. This condition can be seen during simple activities such as laughing and yawning, during long dental consultations, during orotracheal intubation, and in episodes of vomiting. The treatment of chronic symptomatic TMJ hypermobility may be organized into; bony alteration, alteration of associated musculature and alteration of the ligaments.

***Keywords*---**TMJ, dislocation, bony alteration, muscle alteration, ligament alteration.

Introduction

TMJ dislocation (luxation) may be considered a long-lasting inability to close the mouth due to locking of the condyle anterior to the eminence that is maintained

by muscle spasms [1]. TMJ dislocation (luxation) occurs when the condyle moves outside the glenoid fossa and becomes fixed in the anterosuperior aspect of the articular eminence, where it cannot be self-reduced. [1] The pathophysiology of mandibular dislocation involves the combination of three factors: loosening of the capsule and the TMJ ligaments, a prominent eminence, and muscular spasm.[2] Initially, loosening of the capsule and ligaments allows the condyle to perform non-physiological and excessive motions, bypassing the articular eminence. This condition can be seen during simple activities such as laughing and yawning, during long dental consultations, during orotracheal intubation, and in episodes of vomiting. [3-5].

Other aetiological factors associated with TMJ dislocation are trauma, the use of anti-emetics and phenothiazine, which produce extra-pyramidal effects, systemic diseases such as rheumatoid arthritis, and psychogenic and neurological disorders. [6,7]. It was found that dislocation occurs more frequently in patients with TMJ internal derangement, occlusal disturbances (loss of vertical height), joint laxity and neurological disorders [8,9]. In the edentulous patient, there is no opposing dentition, the mandible may become hypermobile and overclose, so the TMJ capsule and lateral ligament can permanently stretch and loosen which can lead to dislocation when force is placed on the mandible [10]. The treatment of chronic symptomatic TMJ dislocation may be organized into; bony alteration, alteration of associated musculature and alteration of the ligaments. [11].

Bony alteration
Eminectomy

Initially described by Myrhaug in 1951, eminectomy is completed with aims of reducing the vertical height of the articular eminence, such that in the event of condylar hypermobility and dislocation, the condyle will slip posteriorly back into the fossa without significant anatomic restriction. [12]. The procedure is typically completed using a standard endaural or preauricular incision, with anterior/temporal extension. Dissection is carried to the superficial layer of the deep temporal fascia. This fascia is incised, with anterior release as needed (extending obliquely antero-superiorly at a 45 angle so as to minimize trauma to the temporal branch of the facial nerve) [13,14] At this point, the periosteum is incised on the zygomatic arch, and dissection is carried anteriorly, to the level of the articular eminence. The eminence is then reduced to its medial margin with burs, osteotomes, or combination . [14] The lateral tubercle of the eminence may be left in place as a guide plane, or removed. [14].

The decision as to whether this is a unilateral or bilateral procedure depends on the underlying joint aberrancy. Patients are encouraged to comply with a soft diet for the first week post-operatively. Gentle physical therapy then ensues, to ensure maintenance of functional opening. Risks of this procedure include intracranial violation and damage to local neuromotor bundles.[14]

Dautrey's Procedure

Because eminectomies alone can turn a dislocation into a subluxation, techniques aimed at creating a mechanical interference to condylar translation have been

described extensively in the literature . In 1933, Mayer described segmental dislocation of the zygomatic arch to act as a physiologic obstruction to condylar hypermobility. [15] 10 years later, LeClerc and Girard described a similar procedure, wherein a vertical osteotomy was created in the zygomatic arch, inserting the osteotomized segment to impede the path of the hypermobile condyle.[16,17] Modifying the paradigm yet again, in 1967 Gosserez and Dautrey described a similar procedure, similarly aimed at greenstick fracture of the zygomatic arch, with fossa inset. [18].

Despite the variations, all of the procedures share a similar end point. The technique is described as follows. A preauricular incision is created, with a slight anterior temporal extension. Dissection ensues to the superficial layer of the deep temporal fascia. This fascia is incised through, proximally, near the root of the zygoma. The TMJ capsule is not violated. An osteotomy is then created in the zygomatic arch, anterior to the eminence, extending from posterior–superior to anterior inferior, in an oblique fashion. Gentle pressure is exerted proximally on the osteotomized arch, to create a greenstick fracture, anteriorly. The osteotomized proximal arch is then mobilized medially or laterally and inset under the articular eminence. Once inset, the segment may be held in place by a mini plate, or simply left passively.[19-22] Once the procedure has been completed, patients are placed on a soft diet, with restriction of function over 2 to 3 weeks. [19]

Complications of Dautrey's procedure include localized neurosensory and neuromotor aberrancies. Additionally, there is risk of complete fracture of the zygomatic arch, which requires rigid stabilization. Occasionally, grafting of the surgical site is indicated, in the event that the osteotomized segment is not robust enough to prohibit movement.[19]

Other Blocking Procedures

Not unlike Dautrey's procedure, blocking procedures are aimed at interfering with translation by increasing the overall mass of the articular eminence, so as to act as a physical stop to prevent excessive translation of the condylar head.[23] There have been a variety of techniques described, all with the common end point of creating a physiologic stop. This can be accomplished using a titanium miniplate, interpositional bone graft, or blocks of hydroxyapatite. [23,24] Glenotemporal osteotomy with autogenous grafting can be completed using various graft donor sites; however, the most frequently described techniques typically use iliac crest or cranium. [23-26] In this technique, the joint is accessed as previously described, with subperiosteal dissection to the articular eminence. A sagittal saw or fissure bur is used to create a horizontal osteotomy along the eminence, which is subsequently downfractured, maintaining intact periosteum. [23,24].

Once the eminence has been down fractured, the harvested bone is then shaped and inset as an interpositional graft between the zygomatic arch and down fractured eminence .[27] Depending on the stability of the inset graft, wires, screws, or mini-plates may be used to secure the graft.[24] Mini-plates have also been described in the context of physiologic blocking procedures. There are many clinical permutations; however, the end point is the same. The approach to the

TMJ is completed as heretofore described. Once the articular eminence has been visualized, an L plate is placed, with the short arm fixed laterally to the eminence with 2- 6 mm screws and the long arm being contoured and placed along the eminence, inferiorly, to act as a mechanical obstruction. Careful attention is given so as to remain extra-capsular during the procedure. [28]

Proponents of mini-plate placement advocate the procedure based on its reversibility and relatively less invasive nature.[28] That being said, there is risk for plate fracture, in addition to a lager reduction in maximum interincisal opening. [28-30] In the event of plate fracture, a second surgery must be undertaken, to remove the hardware, and a decision must be made as to whether additional treatment might be undertaken.[29]

Wolford's Procedure

This relatively simple procedure uses 2 Mitek minibone anchors with osseointegration potential. A #2 Ethibond suture is looped through the threading device and pulled through the eyes of both Mitek anchors. The looped end is cut, so now there are 2 separate artificial ligaments through the eye of each Mitek anchor. An endaural or preauricular incision is used for access to the TMJ and dissection completed exposing the zygomatic arch and lateral capsule. The lateral pole of the condyle is exposed, and 1 anchor is placed in the lateral pole of the condyle.[31]

The other anchor is placed in the very posterior root of the zygomatic arch. The 2 sutures are then adjusted for the amount of mobility desired and tied. If the patient has chronic forward posturing of the mandible, then the 2 artificial ligaments can be tightened to keep the condyle seated in the postero-superior aspect of the fossa, preventing forward translation . [31]

If the procedure is used to prevent dislocation anterior to the articular eminence, then the artificial ligaments can be left slack to provide translation but limit forward movement so the condyle cannot translate beyond the articular eminence. This will allow relatively normal movement of the condyle including excursive movements. No eminectomy is needed with this procedure. If the articular disc is dislocated, then a third anchor can be used to reposition the disc into a normal relationship .Potential risks with these techniques include rupture or breakage of the sutures or failure of the Mitek anchors. Wolford and colleagues [31] reported good success in 5 cases treated with this technique.

This same tethering philosophy can be applied to patients with total joint prostheses that can become displaced. For the TMJ concepts total joint prosthesis, dislocation or subluxation can occur, although rare. In cases of large tumor resection, in which the muscles of mastication are reflected or partially removed, there is a risk of condylar displacement and dislocation related. [32]

Muscle alteration

Various surgical and non surgical interventions have been proposed for alteration masticatory muscle to limit forward excursion of the condylar head including

scarification of the temporal tendon myotomy of the lateral pterygoid muscle . [33] Lateral pterygoid myotomy has been described as being performed transorally and percutaneously, using a preauricular incision. [34] The preauricular approach is completed with the patient under general anesthesia. The patient mouth is opened maximally, and local anesthesia is infiltrated along the medial and lateral upper mandibular ramus. A vertical incision is then created, extending from the coronoid process, along the ascending ramus to the distal of the most posterior tooth. Soft tissues are elevated from the medial mandible, followed by blunt/scissor dissection to visualize the lateral pterygoid. The lateral pterygoid is then detached from the condyle/anterior capsule. .The wound is closed, and the patients are placed into maxillomandibular fixation (MMF) for 7 days. Briefly, not unlike lateral pterygoid myotomy, temporalis scarification is a treatment modality aimed at creating cicatricial restriction of dynamic muscular function, so as to reduce condylar translation.[34]

Therapeutic use of botulinum toxin type A in the head and neck region has significantly increased over the past decade. Botulinum toxin type A induces a dose-related weakness of skeletal muscle by inhibition of acetylcholine release at the neuromuscular junction. When used in the treatment of dystonia or other neurogenic disorders, repeat injections at 3- to 6-month intervals are required for maximal therapeutic efficacy. [35] In the context of chronic recurrent TMJ dislocation, there are many reports of the use of botulinum toxin type A, both as a primary therapy, and as an adjunct to other reductive techniques. [35-38] It is often employed in patients who may not be candidates for surgery, based on age, medical comorbidities, and other factors. Most frequently, the targeted muscle is the lateral pterygoid, which is often implicated in myospasm associated with dislocation. That being said, it may also be infiltrated into any of the masticatory musculature.[37]

Computed tomography (CT) imaging can be completed preoperatively, so as to create accurate measurements from the skin surface to muscle belly. Fu and colleagues [35] described accessing the lateral pterygoid percutaneously through the sigmoid notch, inferior to the zygomatic arch. Twenty-five to 50 units of botulinum toxin type A are deposited directly into the muscle belly, aspirating prior to injection to avoid inadvertent intravascular injection. [34] In addition to percutaneous injection, botulinum toxin type A may also be injected transorally into the lateral pterygoid under continuous electromyography (EMG) control/guidance.In many instances, a single injection may be sufficient. [34,35,38]. Adverse effects of injection include hemorrhage and intravascular injection. Additionally, there is risk of toxin-induced transient velopharyngeal insufficiency, dysarthria, and dysphagia. Fortunately these events are unlikely, and symptoms typically subside between 2 and 4 weeks. [34, 39]

Ligament alteration

Various therapeutic approaches have been designed to limit the forward excursion of the condylar head mainly by tightening and limiting capsular laxity. These approaches involve capsular plication, ligamentorrhaphy, immobilization of the mandible and prolotherapy (sclerotherapy). Capsular plication , to tighten the TMJ capsule and limit translatory movement of the mandibular condyle , is a

relatively simple method that involves exposure of the capsule followed by incision of the exposed lateral capsule, removal of redundant capsular tissue, and suturing back on itself. **(10)**.

It is based on suspected etiology of excessive capsular laxity, but capsular laxity is likely the result of chronic dislocation rather than the cause, so recurrence was expected since the cause has not been corrected. (10). While ligamentorraphy invoves anchoring the lateral ligament of the capsule to the periosteum of zygomatic arch, followed by intermaxillary fixation for a week. Strengthening of the ligaments by surgically exposing the temporalis fascia and suturing a flap of fascia on the capsular ligaments was also reported (40). Immobilization of the mandible by maxillomandibular fixation may be used by itself or in conjugation with other treatment modalities. As immobilization has been recommended for period of 3-6 weeks to facilitate healing of the damaged ligament (41).

Prolotherapy

Proliferative injection therapy (prolotherapy), also known as "regenerative injection therapy" and "growth factor stimulation injection," has been used to improve human ligament, tendon, and joint healing for more than 60 years. Prolotherapy, as defined by Webster's Third New International Dictionary, is "the rehabilitation of an incompetent structure, such as a ligament or tendon, by the induced proliferatin of cells." "Prolo" comes from the world proliferate. (42) It has traditionally been thought of as a method of strengthening lax ligaments by injecting various types of sclerosing or proliferant solutions. (43). Prolotherapy injections proliferate or stimulate the growth of new, normal ligament and tendon tissue. (43) In human studies on prolotherapy, biopsies performed after the completion of treatment showed statistically significant increases in collagen fiber and ligament diameter of up to 60%. (44)

Various agents have been used for prolotherapy including psyllium seed oil, (45) dextrose (46) and combinations of dextrose, glycerine and phenol. (47) However, hypertonic dextrose is commonly used, as it is inexpensive, readily available and reported to be safe. (48, 49).

Conclusion

TMJ dislocation (luxation) may be considered a long-lasting inability to close the mouth due to locking of the condyle anterior to the eminence that is maintained by muscle spasms.There were different modalities in management of TMJ dislocation between surgical intervention as bony ,muscular and ligament interventions, also and non surgical intervention as injections of sclerosing agents as in prolotherapy with varying degree of success .

Compliance with Ethical Standards

Funding: No funding received
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Ethical approval: All procedures performed in studies involving human participants were in accordance with the clinical standards of the institutional and

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