Management of Temporomandibular Disorders using Prolotherapy: A Review of Current Concepts

INTRODUCTION

Temporomandibular disorder (TMD) is a collective term describing various clinical problems involving the muscles of mastication, the temporomandibular joint (TMJ), and the associated structures. The TMJ or the craniomandibular articulation with mandibular codyles and squamous temporal bones as the bony elements is a complex joint both morphologically as well as functionally. Disorders of TMJ are painful and are also responsible for the decrease in quality of life.

With the exception of traumatic etiology, the exact cause of most TMDs remains either largely unknown or speculative. Various management modalities have been used to relieve the patients of the pain and discomfort secondary to TMDs. Among these, Proliferative injection therapy (also called as prolotherapy (PrT), regenerative injection therapy) has been in use over the last 65 years. It involves the injection of a medicament at the tendon and ligament insertions in order to stimulate fibrous tissue proliferation. The purpose of PrT in TMD management is to enhance tendon, ligament, and joint healing.

TMJ Anatomy

The TMJ represents an articulation of the mandible to the temporal bone with a dense fibrous connective tissue called the “articular disc” separating the bony components. Anteriorly, the articular disc continues as the anterior attachment and is fused to the capsule of TMJ. Posteriorly the disc continues as the posterior attachment or bilaminar zone. The articular capsule attaches laterally to the articular tubercle. This reinforced lateral portion of the capsule is called the temporomandibular ligament. The sphenomandibular ligament (SML) and the stylomandibular ligament (STML) are the two accessory ligaments of the TMJ complex (Figure 2). The SML arises from the spine of the sphenoid bone and is inserted on the mandible at the mandibular lingual. The STML is a reinforced sheet of the cervical fascia that extends from the styloid process and stylohyoid ligament to the region of the mandibular angle.

Patho-Physiology of TMJ Pain

Pain, as defined by the task force on taxonomy of the international association for the study of pain is “an unpleasant sensory and emotional experience associated
with actual or potential tissue damage or described in terms of such damage.” The most common cause of TMJ pain is myofacial pain dysfunction syndrome and primarily involves the masticatory muscles. A known cause of persistent muscle spasms and myofacial pain dysfunction is the underlying ligament laxity. Substantial elongation of the fibrous tissue occurs when there is a rupture of a portion of the inelastic collagen fibers within the tissue. As a result, there is hypermobility of the joint allowing excessive strain on the sensory nerves, which results in nociception at the fibro-osseous junction that is perceived as joint pain. Over a long span of time, hyperfunction, and parafunction are also capable of causing tendon and ligament rupture and elongation. Ligament rupture or elongation is defined as permanent injury as collagen fibers generally heal incompletely while the elastin fibers do not heal at all. Since it is difficult to immobilize the TMJ without surgical inter-maxillary fixation, continued function on injured joint aggravates and complicates the injury.

**HISTORY OF PrT**

Hackett and Hemwall are considered as pioneers of PrT. Hackett began performing PrT as early as 1939. In fact, he was the first to scientifically demonstrate the strengthening of ligaments by the injection of a proliferative solution. Gedney have also published many articles on their experiences performing PrT. Incidentally, the first published article on PrT focused on treating the TMJ.

**PRINCIPLE OF PrT**

Webster’s third new international dictionary describes PrT as “the rehabilitation of an incompetent structure, such as a ligament or tendon, by the induced proliferation of cells.” PrT is based on the concept that the cause of most chronic musculoskeletal pain is ligament and/or tendon laxity. PrT uses an inflammatory mimetic that re-initiates the inflammatory process in the joint thus, stimulating fibroblast proliferation thereby augmenting the healing process and strengthening the joint, tendons, and ligaments.

**MECHANISM OF ACTION OF PrT**

The process of inflammation plays a crucial role in wound healing. In the event of an injury, inflammatory cells such as the granulocytes, monocytes, and macrophages migrate to the injury site. Fibroblasts are activated by the growth factor that is released, and they produce matrix and new collagen fibrils. But these collagen fibrils do not align with the original connective tissue. Instead, they grow at right angles to the plane of the injury. The integrity of the zone of healing is further compromised as the elastin fibers do not heal at all. Anti-inflammatory medications usually prescribed after injury allay pain and swelling but unfortunately they diminish the healing response. As a result of this incomplete healing, the joint remains painful with normal or even sub normal physical activity. Such a joint may become hypermobile and prone to re-injury due to incomplete ligament support.

In PrT, an inflammatory mimetic agent like dextrose is injected into the joint to initiate low-grade inflammation.
Fibroblast proliferation is initiated, and the osteoprogenitor cells present in the periosteum lay down reparative bone at the fibro-osseous junction, further strengthening the connective tissue attachment. Repair at the fibro-osseous junction is also facilitated by the periosteal blood flow which is critical considering the relative avascularity of the tendons and ligaments. Dextrose is also thought to increase the production of growth factor by generating an osmotic gradient.

PrT may also be beneficial in TMD management owing to its anti-microbial effect. Chlamydia, Mycoplasma genitalium, Staphylococcus aureus, Mycoplasma fermentans, Actinobacillus actinomycetemcomitans, and Streptococcus mitis have been cultured from the TMJ. The presence of S. aureus in the TMJ synovial fluid has been related to TMD. The bacteriostatic water used in PrT along with the osmotic concentration produced may inhibit the growth of and/or kill these organisms.

**CONSTITUENTS OF PrT SOLUTION**

The PrT solution consists of four agents—an osmotic agent, an inflammatory mimetic, a chemical irritant, and a physical irritant. Dextrose is most commonly used in a concentration of 12.5% as an osmotic agent, prepared by diluting one part of 50% dextrose in 1% methyl paraben (preservative) with two parts of 1% free lidocaine and one part of bacteriostatic water. Sodium morrhuate serves as the inflammatory mimetic attracting the inflammatory cells at the site of injection. Phenol and pumice flour serve as the physical and chemical irritants, respectively, attracting the macrophages and granulocytes by either foreign body reaction or cell wall damage/alteration.

**TECHNIQUE OF PrT FOR TMD**

A reclined or supine patient position is preferred to provide head stability. The head is turned to the opposite side away from the injection site. An antiseptic is used to cleanse the skin before marking the anatomical marks. Patient is asked to close the anterior teeth by biting on two small bite block thus, providing access to the superior joint space. A 3cc syringe with 30-gauge needle and 1-inch length is chosen to penetrate the skin midway between the tragus and the posterior aspect of the condyle, directing it superiorly and anteriorly toward the superior joint space where it makes contact with the periosteum where a little resistance is felt. A common schedule is at an interval of 2, 4, and 6 weeks over a total of 12 weeks. The injection site is checked for bleeding after withdrawal of the needle, and the patient is allowed to rest for some time.

**INDICATIONS OF PrT**

- Evidence of a tendinous or ligamentous injury or disorder
- Willingness of the patient to undergo the injection therapy irrespective of the discomfort
- In refractive cases where conservative management like-medical, physical, dietary, home care therapy have failed
- Where surgical management is not possible
- To enhance recovery as an adjuvant to other treatment procedure like oral appliances.

**CONTRAINDICATIONS OF PrT**

- Allergy to the components of PrT solution
- An active infection at the site of injection
- A healing disorder
- Conditions associated with excessive bleeding like hemophilia
- A malignant condition
- Presence of parafunctional habits.

**SIDE EFFECTS AND POTENTIAL COMPLICATIONS**

In some cases of PrT, a temporary posterior open bite may result due to the distraction of the condyle and mandible inferiorly secondary to the introduction of the injection fluid into the articular space. If there is a rapid reduction of a displaced disc, it may lead to permanent occlusal changes with teeth settling into solid occlusion through passive eruption. Orthodontic or prosthodontic correction may then be needed in these cases to stabilize the occlusion. Postinjection morbidity may result from a faulty injection technique. With TMJ PrT, some potential complications include discomfort during the procedure, temporary anesthesia extending as far as the eye leading to ptosis, external bleeding, or facial bruising.

**CONCLUSION**

PrT has been shown to be an efficient and conservative method in the management of TMDs. By stimulating ligament and capsular repair, it represents a more permanent solution to the persistent and refractory problems associated with the TMJ. Since fibrous tissue proliferation may continue for as long as 18 months, patience of both the practitioner as well as the patient is important.
REFERENCES


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