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Assessment of dextrose injection prolotherapy using intermaxillary fixation for Management of temporomandibular joint hypermobility

Karim Saber Adam Hassan (1), Mahmoud Ahmad Abdallah (2), Ahmed Mohamed Hosni (3)

1) General Dentist, Egypt

(2) Professor, Department of Oral and Maxillofacial Surgery, Faculty of Dental Medicine, Boys, Cairo Al-Azhar University.

(3) Lecturer, Department of Oral and Maxillofacial Surgery, Faculty of Dental Medicine, Boys, Cairo Al-Azhar University.

Corresponding author: Karim Saber Adam Hassan

Email: Karim.hendawy10@yahoo.com

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Abstract: Background: The purpose of this prospective randomized controlled trial was to determine whether or not intermaxillary fixation in conjunction with dextrose injection prolotherapy was effective in treating hypermobility of the temporomandibular joint.

Patients and methods: Twenty patients suffering with TMJ hypermobility were the subjects of this investigation. Each patient was randomly assigned to one of two groups: In Group A, patients received a single injection of 25% dextrose into the back of their joints around the joints. For two weeks, patients in Group B received a combination of 25% dextrose and IMF. At 2 weeks and 1, 3, and 6 months postoperatively, we measured interincisal distance, digital panoramic radiograph, incidence of recurrent dislocation, joint sound, and TMJ pain.Twenty patients suffering with TMJ hypermobility were the subjects of this investigation. Each patient was randomly assigned to one of two groups: In Group A, patients received a single injection of 25% dextrose into the back of their joints around the joints. For two weeks, patients in Group B received a combination of 25% dextrose and IMF. At 2 weeks and 1, 3, and 6 months postoperatively, we measured interincisal distance, digital panoramic radiograph, incidence of recurrent dislocation, joint sound, and TMJ pain.

Results: During the follow-up periods, the data showed that both groups experienced a decrease in MMO, a marked improvement in TMJ pain on palpation, tenderness, number of dislocations, and joint sound. Mean MMO values were considerably lower in Group B compared to Group A at the 3- and 6-month follow-ups.

Conclusion: Prolotherapy with 25% shows promise for the treatment of symptomatic TMJ hypermobility due to its therapeutic benefits, ease of administration, safety, and absence of major adverse effects. Implementing IMF following the injection of dextrose enhances the outcomes.

Introduction

When the temporal pharyngeal joint (TMJ) is hypermobile, it means the condylar head moves abnormally and excessively front of the eminence when the mouth is open wide. This aberrant movement can either be reduced on its own (subluxation) or requires the help of a dentist or oral surgeon (dislocation). Everyday motions like yawning and laughing can trigger recurring subluxation or dislocation of the temporomandibular joint (TMJ). Patients often experience discomfort due to their ongoing concern of dislocation (1, 2).

The treatment of TMJ hypermobility has been documented using a variety of methods. Capsular plication, lateral pterygoid myotomy, condylectomy, scarification of the temporalis tendon, eminectomy, and augmentation of the articular eminence (miniplates, implants) were among the surgical methods that were considered. Intermaxillary fixation, intracapsular injections of sclerosing solutions such alcohol, intramuscular injections of botulinum toxin, intra-articular injections of autologous blood, and prolotherapy were comprised of the conservative treatment techniques (3–13).

A dextrose solution is injected into the area around the tendons or ligaments as part of prolotherapy. It is thought to start a process, either non-inflammatory or inflammatory, that deposits new fibers, which will strengthen ligaments and tendons that are too supple. Although prolotherapy made use of several substances such sodium morrhuate and phenol-glucose-glycerin (P2G), the proliferant most often utilized was dextrose. Because it dissolves in water, is a normal part of blood chemistry, and can be administered in big amounts without problems, it is suitable as a proliferation agent (14,15).

Based on the research conducted by Hegab (16) on the topic of treating TMJ dislocation with autologous blood injection (ABI), intermaxillary fixation (IMF), or a combination of the two, we want to employ dextrose prolotherapy in conjunction with IMF. Combining ABI with IMF yielded the best clinical results, according to his findings. Adding intermaxillary fixation to dextrose prolotherapy is being considered as a potential treatment for TMJ dislocation.

Subjects and Methods:

The twenty participants in this study all had symptomatic TMJ hypermobility. Boys enrolled at Al-Azhar University in Cairo and those attending Sayed Jalal University Hospital's outpatient clinics were the subjects of this study.

All patients were divided randomly into two equal groups (n=10) as the follow:

Group A: patients of this group were received dextrose prolotherapy injection (control group).

Group B: patients of this group were received dextrose prolotherapy injection in addition to IMF for 2 weeks (study group).

Patient Selection:

Selection of patients were based on specific inclusion and exclusion criteria as the follow:

A. Inclusion Criteria:

Patient who suffering from symptomatic TMJ hypermobility (subluxation or dislocation)

B. Exclusion Criteria:

1. Patients who had dystonia or drug induced hypermobility.
2. Patients who had history of allergic reaction to dextrose therapy
3. patients who had history of previous TMJ surgery or recent TMJ trauma

- **Ethical Consideration:**

This study was carried out after approval of ethical committee, Faculty of Dental Medicine, Al-Azhar University, Cairo, Boys.

- **Patient Consent:**

Each patient was signed an informed consent having details about the whole procedures before starting of the study. After getting informed consent from the patient, the treatment was done.

- **Preoperative Evaluation:**

1. Name, age, sex, profession, and major complaint will all be part of the complete history. Documentation of TMJ discomfort, soreness, and dislocations occurring within the past three months was done.
2. Joint sounds and abnormal excursion of the condyle sliding over the articular eminence can be detected by palpating the TMJ on both sides in the preauricular area, anterior to the auricular tragus. With the left index finger on the right TMJ and the right index finger on the left TMJ, this testing can be done bilaterally.
3. A visual analogue scale (VAS) with ten points was used to measure the degree of pain. At the very left of the visual analog scale was the "0" for no pain at all. An extreme case of intense pain, denoted as a '10' on the right-hand side,[18].
4. Patients will have their maximum voluntary interincisal mouth opening (MMO) assessed in millimeters. Using a calibrated fiber ruler, we will measure, to the closest millimeter, the distance between the incisal edges of the upper and lower incisor teeth.[19].

Preoperative radiographic examination:

Digital panoramic radiograph was taken on both TMJs in open and close position to demonstrate:

- Osseous abnormalities of the condyle and temporal eminence.
- Condyle –articular eminence relation in opening and closing mouth position.
- Determination of the contemplated IMF screws sites.

Prolotherapy injection technique:

- Local anaethesia technique:

Applying a povidone iodine antiseptic solution, the area surrounding the TMJ was gently cleaned. At a position approximately 10 mm anterior to the tragus of the ear along the canthus tragus line, and then 10 mm inferiorly from that point, the needle was inserted into the skin. The auriculotemporal nerve block was initially administered using this site.A 4% articaine injection was administered to the posterior periarticular area using an 18-gauge needle. After a 10-minute pause, 2 milliliters of a 25% dextrose solution was injected. **fig(1.a).**

- Prolotherapy injection technique:

The modified prolotherapy technique suggested by Zhou(25) was applied to both groups.First, 0.5 ml was deposited on the condylar neck surface using the needle. The needle was then advanced along the back of the condyle and inserted into the posterior periarticular tissues to a depth of 25 mm. After that, the needle was withdrawn 5 mm and the last 1.0 ml was cautiously injected. **fig(1.b).**

Intermaxillary fixation with IMF screws technique:

For group B, hefty elastics size 1/4 might be applied by inserting four 12mm × 2mm titanium screws (Synthes) into the maxilla and mandible. While carefully monitoring the placement of the neighboring tooth roots, holes were bored straight into the soft tissue at the junction of the free and attached mucosa between the canines and first premolars. The procedure was accompanied by heavy irrigation with sterile saline. Using elastic intermaxillary fixation to immobilize the jaw for two weeks **fig (1.c).**

(Figure 1).

Figure 1: (a) clinical photograph showing anaesthesia injection. (b) showing dextrose injection. (c) showing IMF screws with elatics

- **Postoperative care:**

After completion of the prolotherapy, patients in group A were instructed to eat soft foods and to avoid forcing the TMJ while yawning, chewing, and speaking for 2 weeks. Patients in group B were instructed to limit their fluid intake at a time and to maintain good oral hygiene. They learned how to cut or remove the elastics themselves in case of emergency (vomit or suffocation). Besides that, all patients were instructed to take paracetamol 500 mg tablet whenever needed as an analgesic in case of postoperative pain.The total allowed maximum dose of paracetamol for an adult is four 500 mg tablets in 24 hours. They were informed to wait at least 4 hours between doses.

- **Postoperative evaluation:**

The patients were asked to return for follow-up after 2 weeks, 1 month, 3 months and 6 months or whenever their TMJ recurrently dislocated. They were assessed for the following:

- The intensity of pain using a 10-point visual analogue scale (VAS).
- The maximum voluntary interincisal mouth opening (MMO) of the patients measured in millimeters.
- Recurrent dislocation.
- Regional tenderness.
- Joint sound.

Statistical Analysis:

Data were collected, tabulated, and statistically analyzed using SPSS® Statistics Version 25 for Windows to detect whether significant differences existed between the means of the various studied groups.

Results:

Maximum mouth opening

At two weeks, one month, three months, and six months, the mean maximum mouth opening measurements in each group showed a substantial decrease in MMO..

In comparison to the two groups that were examined based on MMO. There was no statistically significant difference in the mean maximum mouth opening between the two groups pre-operatively, at 2 weeks, and at 1 month. The two groups' mean maximum mouth openings differed significantly at 3 and 6 months. Researchers found that the mouth openness was lower in the IMF + Injection group compared to the Injection group. **(Table 1)**.

Table (1): Comparison between the two studied groups according to maximum mouth opening

	Injection	**IMF + Injection**	**t**	**p**
Maximum mouth opening				
Pre-operative	42.37± 3.14	43.64 ± 3.45	0.789	0.442
2 Weak	23.88 ± 3.29	22.98 ± 3.89	0.511	0.617
1 Month	28.68 ± 3.77	27.58 ± 2.79	0.677	0.508
3 Months	34.91 ± 5.10	30.71 ± 1.58	2.355	0.033*
6 Months	36.0 ± 0.76	32.11 ± 1.69	6.233	<0.001*

VAS

Using a scale from 0 to 10, the palpation-based assessment of TMJ pain was conducted.

At two weeks, one month, and three months, the two groups' mean VAS measurements were significantly different from one another. At the 6-month mark, the difference was not statistically significant.

In comparison to the two groups that were examined. Mean visual analog scale scores were not significantly different between the two groups before surgery, at 2 weeks, 1, 3, and 6 months.

Recurrent dislocation

Differences between groups :

preoperative;

There was no difference in percentage of recurrent dislocation at preoperative between the two groups.

Two weeks post-operative;

The difference in percentage of recurrent dislocation at two weeks between the two groups was not performed .

One month post-operative:

The difference in percentage of recurrent dislocation at one month between the two groups was not performed .

Three months post-operative :

The highest percentage of recurrent dislocation at 3 months was recorded for group 1, while the lowest percentage was recorded for group 2. The difference between groups was significant.

Six months post-operative :

The highest percentage of recurrent dislocation at 6 months was recorded for group 1, while the lowest percentage was recorded for group 2. The difference between groups was significant.

Joint sound

Differences between groups :

preoperative;

There was no difference in percentage of joint sound at preoperative between the two groups.

Two weeks post-operative;

The difference in percentage of joint sound at two weeks between the two groups was not performed .

One month post-operative:

The difference in percentage of joint sound at one month between the two groups was not performed .

Three months post-operative :

The highest percentage of joint sound at 3 months was recorded for group 1, while the lowest percentage was recorded for group 2. The difference between groups was significant.

Six months post-operative :

The highest percentage of joint sound at 6 months was recorded for group 1, while the lowest percentage was recorded for group 2. The difference between groups was significant.

Discussion:

When the jaw moves too far forward in relation to the joint when the mouth opens wide, a condition known as temporomandibular joint hypermobility occurs. Inability to close mouth, preauricular pain, and sensitivity of the masticatory muscle are some of the discomforts caused by hypermobility of the TMJ. [17].

The treatment of TMJ hypermobility has been found to involve a range of surgical and non-surgical options. Surgical techniques that were employed in these cases ranged from capsular plication and lateral pterygoid myotomy to scarification of the temporalis tendon, eminectomy to reduce the articular eminence, and miniplates and implants to increase it (18,19).

The conservative methods of treatment included procedures such as intermaxillary fixation (IMF), intracapsular injection of alcohol sclerosing solutions, intramuscular injection of botulinum toxin, intra-articular injections of autologous blood, and prolotherapy (2).

A type of injection therapy called prolotherapy can help strengthen and heal chronic ligament, joint, capsule, and tendinous injuries. It works by stimulating the proliferation of collagen at the fibro-osseous junctions, which in turn promotes soft tissue repair and pain relief (22).

This study set out to determine if treating temporomandibular joint hypermobility with dextrose injection alone or in conjunction with intermaxillary fixation yielded better results.

Patients with dystonia, drug-induced hypermobility, or a history of TMJ surgery that may change the structure of the TMJ were not included in this study. Increased capsule fragility and ligament laxity are the results of these variables.

A statistically significant reduction in maximal mouth opening was seen in both groups for the course of the current study's follow-up periods. Since dextrose was administered to every patient in both groups, its action explains this. These findings corroborated those of Refai et al. (23) who found that the dextrose group had a considerably larger percentage reduction in MMO than the placebo group. In addition, these findings corroborated those of Majumdar et al.(24), who found a substantial drop in MMO between the pre- and post-operative periods.

Zhou et al.(25) states that he achieved a 91% success rate following dextrose prolotherapy in a group of 45 patients. To achieve success, there had to be no dislocation or subluxation occurrences for at least six months, and MMO demonstrated a statistically significant decrease.

In a retrospective analysis of ten patients given 10% dextrose prolotherapy, Ungor et al.(10) found no concordance between our findings and theirs. There was a decline in MMOs, according to him. The decline did not reach statistical significance. The fact that injections of dextrose at concentrations below 10% do not induce a histological inflammatory reaction explains this. When injected with a solution that contains more than 10% dextrose, it is believed to attract inflammatory cells and start the healing process (26). Therefore, dextrose 25% was utilized in the present investigation (24).

The present investigation found no statistically significant difference in mean MMO between the IMF + injection group and the injection group alone at the 2-week and 1-month follow-up periods. Reason being, during the duration of the two weeks, patients in the dextrose group were told to avoid yawning and chewing on hard items, and to eat soft foods exclusively.

At both the 3- and 6-month marks, the present study found that the IMF + injection group had a significantly lower mean MMO than the injection group alone. This is because the delayed response of IMF had a beneficial effect on MMO measures, and two patients in the injection group only experienced recurrent dislocation at three months, after which they received a second injection. Joint capsule mature fibrosis can be aided by IMF (16).

This finding corroborated that of Hegab (2013)16 on the treatment of TMJ dislocation using autologous blood injection (ABI) alone, intermaxillary fixation (IMF) alone, or a combination of the two. Combining ABI with IMF yielded the best clinical results, according to his findings. Therefore, TMJ hypermobility was successfully treated with intermaxillary fixation in addition to dextrose prolotherapy.

Combining dextrose in the TMJ with immobilization can stabilize the newly produced fibers, which is the rationale behind the combination therapy. Excessive opening of the mouth can compromise the fibrosis's integrity and cause hypermobility by releasing the obtained constraint (16).

Adding IMF to dextrose injection greatly improved results in the current study, especially at the 3- and 6-month follow-up periods. It is supported by the use of the combined action of IMF as none of our patients who received the combined treatment experienced a recurrence of dislocation. During the time that dextrose injection is effective, it limits the motion of the condyle.

In this study, we categorized each group based on VAS. A statistically significant difference was observed in the decrease of mean pain (VAS) values between the two groups. This is because prolotherapy aids in stabilizing the joint by strengthening and repairing damaged ligaments.When the joint is properly supported, the pain

should go away. Alderman et al.(27) found the same thing.Patients with TMJ dysfunction and pain that had persisted for over five years were the subjects of his investigation, in which he employed the dextrose PrT approach. Patients whose TMJ pain and dysfunction have not been adequately addressed may want to consider PrT as a potential treatment option. In addition, Refai et al.(23) found that there was a statistically significant reduction in pain intensity across all follow-up periods for both groups.

The present investigation found that both groups experienced a statistically significant reduction in mean recurrent dislocation and joint sound. Zhou et al. (25) agree with these findings. He came to the conclusion that dextrose is more effective in inducing tissue repair. Recurrent TMJ dislocation episodes and clicking noises were significantly reduced after injecting 50% dextrose to patients. Additionally, this finding is in line with that of Comert kilic and Gungromus (21) who found a substantial reduction in joint sound in both groups.

Conclusion:

In order to initially control tempromandibular joint hypermobility, the majority of the findings obtained in this study support the combination therapy (IMF with dextrose injection). Still, studies examining the efficacy of prolotherapy in large-scale patient populations requiring long-term follow-up are urgently required.

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