



## ASSESSMENT OF THE THERAPEUTIC EFFECTS OF AUTOLOGOUS BLOOD VERSUS DEXTROSE PROLOTHERAPY FOR THE TREATMENT OF TEMPORO- MANDIBULAR JOINT HYPERMOBILITY. A RANDOMIZED PROSPECTIVE CLINICAL STUDY

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### ABSTRACT

**Objectives:** The aim of the current study was to assess the injection of autologous blood versus the dextrose prolotherapy for the treatment of TMJ hypermobility.

**Material & methods:** This study was conducted on 30 patients who had TMJ subluxation. Patients were divided into 2 equal groups. Group A: 15 patients received autologous blood injection, and Group B: 15 patients received dextrose prolotherapy. Clinical evaluation was performed through Visual Analogue Scale (VAS) to assess patients' pain preoperatively, at 2 weeks, 1, 3, and 6 months postoperatively. Painless maximum interincisal opening (MIO) was measured preoperatively, 2 weeks, and 3, 6 months postoperatively. Statistical analysis of data was performed.

**Results:** Group B showed a significant ( $p \leq 0.001$ ) higher MIO values compared to Group A for all follow-up intervals. There was Significant ( $p \leq 0.001$ ) reduction in VAS scores at 2 weeks postoperatively in group A. While, the reduction in VAS at 2 weeks was non-significant ( $p \geq 0.001$ ) in group B, but at 1 months postoperatively VAS started to show significant ( $p \leq 0.001$ ) reduction.

**Conclusion:** autologous blood injection was superior to dextrose prolotherapy regarding the number of injections needed, pain improvement, and maximal interincisal opening reduction.

**KEYWORDS:** TMJ subluxation, TMJ hypermobility, chronic dislocation, dextrose prolotherapy, autologous blood injection,

### INTRODUCTION

Subluxation of Temporo-mandibular Joint (TMJ) is defined as the excessive excursion of the condylar head where it moves anterior to the articular eminence during wide mandibular opening, but it is

self-reducible by the patient.<sup>(1-3)</sup> The pathogenesis of TMJ subluxation is as controversial as its treatment. It is reported to be multifactorial.<sup>(4)</sup> It could be soft tissue abnormality as laxity of the capsule/ligaments, and lateral pterygoid muscle hyperactivity or bony

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abnormality in the eminence/fossa, and condyle. It may also be associated with neuromuscular conditions, medications for psychiatric disorders, seizures, and connective tissue disorders. Moreover, it could be attributed to trauma, and prolonged anesthetic and endoscopic procedures.<sup>(5-7)</sup>

Surgical and non-surgical methods have been used for the treatment of TMJ hypermobility. Surgical methods include condylectomy, augmentation of the articular eminence, eminectomy, lateral pterygoid muscle myotomy, capsular plication, temporalis tendon scarification, and the use of miniplates. Non-surgical methods include physiotherapy, intermaxillary fixation, occlusal splints, and injectable agents.<sup>(8-10)</sup>

The rationale behind using injectable agents is to induce fibrosis of the capsular and peri-articular tissues, which reduces translation of the condyle and hypermobility. There are several injectable agents reported such as sclerosing agents (sclerotherapy), autologous blood, proliferative agents (prolotherapy) and Botulinum toxin.<sup>(11)</sup>

Prolotherapy was first introduced in 1937 by Louis Schultz<sup>(12)</sup> as an effective treatment for painful subluxation of the TMJ. It involves the injection of an irritant solution into a joint space, weakened ligament, or tendon insertion, to relieve pain. It may be given as a single injection or a series of injections.<sup>(13)</sup> The mechanism of action of prolotherapy is not clearly understood. However, it has been hypothesized that it works by causing low grade inflammation at the injection site, which in turn activates fibroblasts, synthesize precursors to mature collagen and reinforce connective tissue. Moreover, the inflammatory process caused by prolotherapy increases the concentration of growth factors as fibroblast growth factor and connective tissue growth factor to initiate a new sequence of connective tissue repair.<sup>(14)</sup> The most common proliferative agent used is dextrose in varying concentrations (10%–50%) and it has

shown impressive outcomes.<sup>(15-17)</sup> Moreover, Dextrose is normal water soluble blood constituent which can be injected in large quantities without complications.<sup>(18-20)</sup>

Autologous blood injection for the treatment of TMJ subluxation was first reported by Brachmann<sup>(21)</sup> in 1964. The rationale behind the injection of autologous blood is the same pathogenesis of post-traumatic hemarthrosis, with the subsequent scarring and limitation in range of condylar motion.<sup>(22)</sup> During the first few days after injection, an inflammatory reaction takes place, resulting in inflammatory mediators release, and accumulation of dead/injured cells, causing oedema of the joint tissue which in turn diminishes joint mobility. Then, a combination of organized blood clots and fibrous tissue forms, which further decreases joint mobility. After maturation of these formed tissues, permanent limitation of joint movement occurs.<sup>(23,24)</sup> Injection of autologous blood in the superior joint compartment and around the capsule has been reported to be a safe, simple, and cost-effective method for the treatment of TMJ subluxation.<sup>(25)</sup>

The aim of the current study was to assess the injection of autogenous blood versus the dextrose prolotherapy for the treatment of TMJ hypermobility.

## MATERIALS AND METHODS

This prospective clinical study was conducted at Oral Surgery and Anesthesia Department, Faculty of Dentistry, MSA University. The diagnosis of subluxation (hypermobility) was based on history and on clinical finding of excessive abnormal excursion of the condyle that slides over the articular eminence, then it returns to the fossa by self-reduction, associated with pain and sound. Radiographic imaging (tomogram) showed the presence of condyles anterior to the articular eminence in the open-mouth position to confirm the diagnosis with reference to the clinical and radiographic criteria established by Nitzan.<sup>(26)</sup>

Patients were excluded if they had drug induced hypermobility, a previous treatment (either conservative or surgical) on the TMJ, or any medical condition that could interfere with the treatment. Thirty patients (19 male, and 11 female, with age range 18-39 years) with bilateral TMJ subluxation were included in the study and signed informed consent. Patients were randomly divided into two equal groups. Group A: in which 15 patients received autologous blood injection. Group B: in which 15 patients received dextrose prolotherapy.

### Preoperative preparation

The patient's face was prepared in the usual sterile manner. Auriculotemporal nerve block was applied with local anesthesia (2% lidocaine with 1:100,000 epinephrine). A line was drawn from the tragus of the ear to the outer canthus of the eye.

### Autologous blood injection (group A)

The point of the articular fossa was found on this line, 10mm anterior to the tragus of the ear and 2mm inferior to the line. At this point, An 18 gauge needle was inserted at this site into the superior joint space of the TMJ. 3 ml of blood was withdrawn from the patient's antecubital fossa; 2 ml of blood was injected into the superior joint space and 1 ml was injected into the outer surface of the TMJ capsule. The same procedure was performed on the contralateral TMJ. Each patient was given three sessions of injections 2 weeks apart if needed. Fig (1)

### Dextrose prolotherapy (group B)

Two points were marked over the canthal-tragus line indicating the articular fossa and condylar neck of each joint. The first point was placed 1 cm in front of the mid-tragus 2 mm below the canthal-tragus line. The second point was placed 1 cm below the first one. Injection syringe with 18-gauge needle was loaded with dextrose solution 3 ml (10% dextrose 2 ml and 2% mepivacaine with 1:20,000 levonordefrin 1 ml). The needle was inserted at

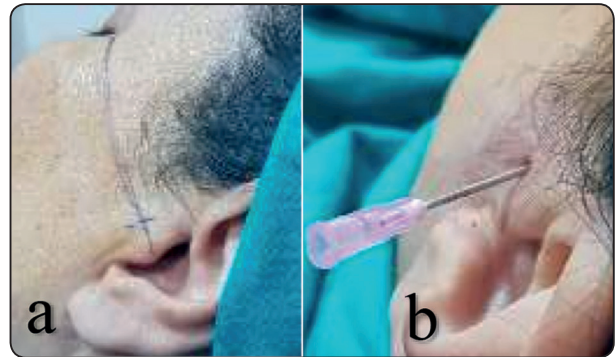


Fig. (1) a) Image showing the point of the articular fossa on the canthal-tragus line, 10mm anterior to the tragus of the ear and 2mm inferior to the line b) Image showing 18 gauge needle inserted into the superior joint space of the TMJ

the first point in an antero-superior direction to the glenoid fossa where the capsule was attached, and 0.7 ml of the solution was injected. The needle was then directed downwards and medially to the superior joint space, and 1 ml was injected. Then, the needle was removed and reinserted at the second point where the capsule was attached to the condylar neck, and 0.7 ml of the solution was injected. Finally, the needle was then directed superficial to the capsule of the TMJ, and the remaining 0.6 ml of the solution was injected with withdrawal of the needle. The same procedure was performed on the contralateral TMJ. Each patient was given three sessions of injections 2 weeks apart if needed.

### Postoperative instructions & medications

An elastic bandage was applied around the patient's head for 2 weeks. Patients were instructed to restrict the mouth opening, and to eat soft food for 2 weeks. Non-steroidal anti-inflammatory drugs were prescribed during the first postoperative week.

### Clinical assessment

Each patient was assessed for pain using Visual Analogue Scale (VAS) of 0-10 with zero being no pain and 10 the worst pain possible. This parameter was recorded preoperatively, 2 weeks, 1, 3, and 6 months after injection. Painless maximum

interincisal opening (MIO) was measured as the distance from the upper central incisors edges to the lower central incisors edges using graduated calipers preoperatively, 2 weeks, and 3, 6 months postoperatively.

**Statistical analysis**

Data presented as mean and standard deviation (SD). Data explored for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests. MIO showed Normal distribution, Repeated Measures ANOVA test used to compare between different tested Groups and Follow-up periods on mean MIO Followed by pairwise comparison with Bonferroni correction. Kruskal Wallis test used to compare between tested groups for VAS score. The significance level was set at  $P \leq 0.001$ . Statistical analysis was performed with IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.

**RESULTS**

The current study was conducted on 30 patients (19 male, 11 female) with age ranged from 18-39 years. All patients of group A (autologous blood injection), and all patients of group B (dextrose prolotherapy) tolerated the technique well and complained of no or minimal pain on injection. There were no incidences of facial nerve palsy in patients of group A, while there were transient facial palsy seen in 5 cases of group B which resolved 2 hours post-operatively as the effect of local anesthesia subsided.

Regarding MIO for patients of the study groups, there was Significant decrease on mean MIO after

2 weeks ( $34 \pm 2.07$ ) with 21.89% decreases compared to pre-operative MIO ( $43.53 \pm 1.55$ ) for group A, and ( $36.67 \pm 1.72$ ) with 15.25% decreases compared to pre-operative ( $43.27 \pm 1.53$ ) for group B. This was followed by farther significant ( $p \leq 0.001$ ) decrease at 3 Months postoperatively (25.88%) for group A, and (20.65%) for group B. While at 6 months postoperatively, no difference was observed

compared to 3 Months in both groups. At preoperative evaluation, there was no difference in MIO between tested groups. However, Group B showed a significant ( $p \leq 0.001$ ) higher MIO values compared to Group A for all follow-up periods. Fig. (2)

At preoperative evaluation, there was non-significant difference ( $p \geq 0.001$ ) between the tested groups regarding VAS. Group B showed a significant ( $p \leq 0.001$ ) higher VAS Scores values compared to Group A at 2 weeks and at 1 month postoperatively. For both groups the median VAS was zero at 3 and 6 months postoperatively. There was Significant ( $p \leq 0.001$ ) reduction in VAS scores at 2 weeks postoperatively in group A. While, the reduction in VAS at 2 weeks was non-significant ( $p \geq 0.001$ ) in group B, but at 1 months postoperatively VAS started to show significant ( $p \leq 0.001$ ) reduction. Fig. (3)

In group A (autologous blood injection), 12 patients (80 %) were given single injection and had successful outcome. While 3 patients (20%) were treated with second injection after 2 weeks and were all successfully treated. While in group B (dextrose prolotherapy), 3 patients (20%) were treated after the second injection, while 12 patients (80%) were successfully treated after the third injection. Hence by the end of our study, the overall success rate was 100 %.

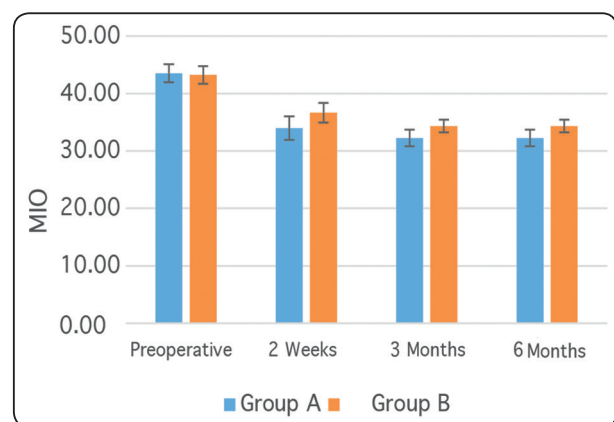


Fig. (2) Graph showing the MIO of the study groups at the different follow up intervals

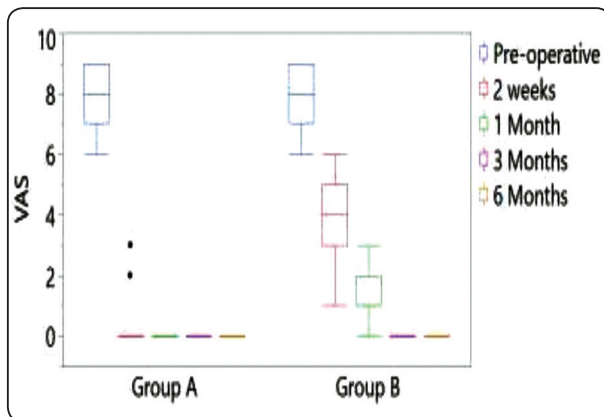


Fig. (3) Box plot showing the distribution of VAS scores for different follow-up periods and tested groups

## DISCUSSION

Autologous blood injection and dextrose prolotherapy of the TMJ were both effective in the treatment of hypermobility of TMJ with regard to significant improvement in pain and decrease in MIO during the follow-up. These findings are consistent with other studies. (8,17,27-29) Daif (22) recently reported in his study that Autologous blood injection to the TMJ in patients with habitual dislocation was a simple, safe, and cost-effective technique. Refai et al. (8) reported that maximum mouth opening showed significant improvement after four injections of 10% dextrose prolotherapy, and pain intensity decreased significantly as well. On the other hand, Ungor et al. (17) injected 10% dextrose for prolotherapy in patients with TMJ dislocation after 6 months, they reported that pain scores decreased significantly; but maximum mouth opening showed insignificant changes. In a short-term evaluation,

We were interested to note that Most of the patients of group B required two or three injections of dextrose prolotherapy. This is consistent with other studies. (8,30,31) On the other hand, 80% of group A patients in the current study showed significant improvement by single autologous blood injection. This finding is consistent with those of Hasson and

Nahlieli (32) who injected 5 ml of autologous blood into superior joint space and pericapsular tissue with good result and no complications. Moreover, Machon et al. (33) conducted a study in 25 patients with TMJ subluxation and found successful outcome in 80% patients at 1 year follow-up.

The current study found that autologous blood injection into the TMJ yielded better outcome at the study intervals regarding the pain and the MIO after only one session of injection. This could be attributed to formation of adhesions in the superior joint space after autologous blood injection together with blood coming from the wounded pericapsular tissue. Moreover, Refai (34) reported that dextrose prolotherapy causes a period of post-injection pain lasts for 1-10 days. Then complete resolution of symptoms occurs within 4-5 weeks. Lastly, recurrence of symptoms of less intensity before the next injection. These symptoms gradually decreased till the third or fourth session of injections.

## CONCLUSION

Autologous blood injection and dextrose prolotherapy are simple, outpatient procedures that are minimally invasive, and less time consuming than surgery. However, autologous blood injection was superior to dextrose prolotherapy regarding the number of injections needed, pain improvement, and maximal mouth opening reduction. Further research in this area is necessary.

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