ORIGINAL ARTICLE

Dextrose neuroprolotherapy and occlusal splint treatment outcomes in occlusal trauma: Evaluation through ultrasound imaging

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ABSTRACT

BACKGROUND: Occlusal trauma has become a common phenomenon among individuals today. Its primary source is bruxism, which involves unusual activities such as clenching and grinding during the day or sleep. The hypothesis is that with 5% dextrose neuroprolotherapy, both the trigger points and affected nerves will be healed, and the muscle will be relieved by eliminating the pain.

METHODS: This study aimed to compare the short-term ultrasonographic results of patients treated with occlusal splint and 5% dextrose neuroprolotherapy for bruxism. Patients were divided into two groups: the dextrose neuroprolotherapy group and the occlusal splint group. In the first group, patients were administered 5% dextrose three times at one-week intervals using the dextrose neuroprolotherapy method. Impressions for both jaws were made using a high-viscosity irreversible hydrocolloid impression material in the second group. An occlusal splint was tailored to fit the upper jaw. Patients were assessed for masseter muscle thickness and strain ratio using ultrasonography before and 3 months after the treatment.

RESULTS: No statistically significant differences were found between the two groups for all measures. Statistically significant differences were observed in the strain ratio of the left musculus massetericus in the resting position and the thickness of the left musculus massetericus in the contracted position exclusively in the neuroprolotherapy group ($p=0.001$, $p=0.011$, respectively). Differences in the strain ratio of both sides of the contracted musculus massetericus were demonstrated in both groups (neuroprolotherapy group: right side $p<0.001$, left side $p=0.007$, splint group: right side $p=0.005$, left side $p=0.012$).

CONCLUSION: This study demonstrates that 5% dextrose neuroprolotherapy is an effective treatment comparable to an occlusal splint. Objectively visualizing changes in the masseter muscle through ultrasound provides clear results in the context of occlusal trauma and bruxism.

Keywords: Bruxism; neuroprolotherapy; occlusal splint; ultrasonography.

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INTRODUCTION

Occlusal trauma has become a prevalent issue among individuals today, primarily caused by bruxism. Bruxism has traditionally been defined as teeth grinding during sleep. However, recent consensus suggests that this definition should be expanded. Bruxism may not only manifest as a pathology or disorder but may also indicate various underlying causes. Additionally, it could represent a motor activity of physiological or protective significance. Various treatment methods are available for bruxism,[1] including occlusal splints, Botox injections, stress management, physical therapy, and dental treatments. An occlusal splint is a device designed to protect the teeth and reduce pressure during clenching or grinding. These splints are custom-fitted to the patient's mouth, typically worn at night, and effectively alleviate symptoms of bruxism.[2] Botox injections temporarily weaken or paralyze the jaw muscles, thereby reducing teeth grinding and clenching movements. However, Botox is a temporary solution, with effects lasting only a few months. Bruxism is often linked to stress and anxiety.[2,3] Stress management techniques such as yoga, meditation, deep breathing exercises, or therapy can significantly reduce symptoms. Physical therapy aims to relax the jaw muscles and alleviate pain through muscle relaxation exercises, massage, or hot/cold compress applications.[2-4] If bruxism has caused dental damage, orthodontic treatment can correct misaligned teeth, and restorative treatments can repair the damage. Treatment options vary depending on the individual's circumstances and the severity of symptoms.[2]

Neuroprolotherapy (NPT) is a treatment proven to be safe and effective for chronic musculoskeletal problems due to its ability to heal or regenerate tissues.[5,6] NPT, also known as neural prolotherapy or perineural injection therapy, involves injecting a solution (typically dextrose, an anesthetic agent, and other substances) into nerves, ligaments, tendons, or other soft tissues. The goal of NPT is to promote healing, reduce pain, and improve function in the affected area.[7-9] The precise mechanism of action of NPT is not yet fully understood and is still a subject of ongoing research. Several proposed mechanisms that may contribute to its therapeutic effects include inflammatory response modulation, neural modulation, increased blood flow, and remodeling of connective tissue.[7-10] Neuroprolotherapy is thought to have an effect on the peripheral nerves in the injected area. The injected solution may interact with the nerve endings and modulate their activity, potentially interrupting pain signals and restoring normal nerve function.[7-10]

The outcomes of these treatments are assessed by observing increases or decreases in patient complaints, while muscle changes can be concretely and objectively identified through specific soft tissue imaging techniques. Ultrasonography (USG) is preferred for soft tissue imaging in the head and neck region. For imaging the masseter muscle, ultrasound (US) has been shown to yield more distinct images compared to magnetic resonance (MR) and computed tomography (CT) techniques.[11]

The hypothesis of this study is that in patients with bruxism, 5% dextrose neuroprolotherapy (DNP) treatment is more effective than occlusal splint therapy in achieving greater relaxation of the jaw muscles and reducing patient complaints more significantly. Additionally, NPT eliminates muscle hypertrophy. In the literature, there are studies on the use of prolotherapy for temporomandibular joint (TMJ) pain and dysfunction and the use of NPT for conditions such as bursitis and meralgia paresthetica.[12-14] However, NPT has not been used in the treatment of bruxism. This study aimed to demonstrate the effectiveness of US in comparing the NPT method using 5% dextrose and occlusal splint therapy in treating bruxism.

MATERIALS AND METHODS

This study included 42 patients aged between 18 and 40, who had not received any other treatment such as Botox or arthrocentesis in the last three months, diagnosed with bruxism in the Department of Oral and Maxillofacial Radiology at Ankara University.

Exclusion criteria were pregnancy, breastfeeding, bleeding disorders, presence of immunosuppressive diseases, cancer, rheumatological or degenerative joint diseases, use of corticosteroids or antithrombotic drugs, presence of other diseases that may cause pain in the TMJ (such as odontogenic or non-odontogenic cysts or tumors), and unstable hypertension or diabetes.

The study was approved by the local traditional and complementary medicine clinical research ethics committee of GETAT (Date: 21/10/2022, Number: 2022/3). All patients were informed about the study and signed an informed consent form. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

After clinical examinations, patients diagnosed with bruxism were randomly divided into two treatment groups: 5% DNP and occlusal splint. For randomization, patients were sequentially assigned to the groups based on their admission order. A total of 42 patients were included, with 28 in the NPT treatment group and 14 in the occlusal splint therapy group. In the occlusal splint group, two patients were unable to use the occlusal splint treatment after enrolment.

Patients' age, gender, height, weight, and US measurements of the masseter muscle were recorded. Ultrasound was performed using an Acuson Juniper device (SIEMENS Healthineers, Erlangen, Germany) with a 12 MHz linear array transducer (12L3). An oral and maxillofacial radiologist with nine years of experience conducted eight different measurements using US. These measurements include:

A) Thickness of the left musculus massetericus in the resting position,

B) Strain-ratio of the left musculus massetericus in the resting position,

C) Thickness of the left musculus massetericus in the contracted position,

D) Strain-ratio of the left musculus massetericus in the contracted position,

E) Thickness of the right musculus massetericus in the resting position,

F) Strain-ratio of the right musculus massetericus in the resting position,

G) Thickness of the right musculus massetericus in the contracted position, and

H) Strain-ratio of the right musculus massetericus in the contracted position.

Patients were instructed to clench their teeth while measurements were taken in the contracted position. These measurements were conducted using B-mode, with patients positioned upright in a sitting posture without any restraint on their heads. To minimize the risk of artifacts, measurements were carried out with the probe positioned perpendicular to the skin surface of the masseter muscle. The probe was delicately placed on the skin surface in a transverse orientation without applying pressure, allowing for measurements from the muscle's thickest region. For assessing muscle thickness, images were obtained while the patient was in a resting state and in a biting position where the muscle reached maximal contraction. The same device and probe were used for the sonographic elastography procedure. To avoid artifact formation caused by the mandible in the image, the region of interest (ROI) was carefully and strategically positioned with the mandible excluded from the image. Elastographic values were derived from both the masseter muscle and the subcutaneous adipose tissue surrounding the muscle. The region of interest shape was circular, which was the only option available when selecting the strain-ratio elastography mode of the device.

The B-mode and elastography images were displayed simultaneously on the same screen. During the elastography examination, the images were overlaid on the B-mode images on a color scale. Care was taken to include the muscle and the surrounding fatty tissue within the elastographic box. The probe was held parallel to the head during freehand manual compression and decompression. The compression quality factor was monitored (bar scale from 1 to 7), and images were obtained when optimal compression was achieved between bar values of 5 and 7. Static and moving images were digitally recorded on the local sonography device for later review. The strain ratio was measured by comparing the muscle to the adjacent fatty tissue. The first ROI of 0.1 cm2 was placed in the adjacent fatty tissue, which was more superficial than the muscle. The second ROI was placed within the muscle itself. The strain ratio was then automatically computed by the US machine. Measurements were performed with more than one ROI, and then the mean value was calculated by determining the ratios between the average strain ratio of the masseter muscle at rest and during maximum contraction, and the average strain ratio of the subcutaneous adipose tissue surrounding the masseter muscle. Elastography of the masseter muscles was conducted at the mid-level of the muscles. Typically, the strain ratio is used as a metric representing the elasticity of a specific tissue relative to the adjacent anatomical structures. In this study, the masseter muscle is the specific tissue, and the subcutaneous adipose tissue was assessed and utilized as the reference tissue.

Figure 1 shows the ultrasonographic images of the masseter muscle's thickness and strain-type sonography. These measurements were conducted both before the treatment and repeated three months after the treatment.

Treatment of 5% Dextrose Neuroprolotherapy Group/Group 1

Intervention: Subcutaneous 5% dextrose was administered at a total of 8 points with detected sensitivity on both sides of the face using the NPT method by a sports physician with 11 years of experience. The volume of solution used during each application was 0.5-1 cc per point. The same physician performed the procedure for all patients.

Measurements on US were performed before the treatment and were repeated three months after the completion of three treatment sessions performed at one-week intervals.

Occlusal Splint Therapy Group/Group 2

Impressions for both jaws (upper and lower) were made using a high-viscosity irreversible hydrocolloid impression material in the second group. In this manner, an occlusal splint was tailored to fit the upper jaw. Patients were instructed to wear this splint during the night. Ultrasonography measurements were performed twice for this non-intervention group: once before the initiation of occlusal splint usage and again three months later.

In both treatment groups, US measurements were conducted twice at identical time points. A G-power analysis determined the total sample size, with a minimum of 42 participants achieving a power of 80% with an effect size of 0.8 and an α-error of 0.05. Specifically, for the NPT group, a minimum of 28 participants was required to achieve the same statistical power and effect size.

Statistical Analysis

The data were analyzed using descriptive statistical methods. Categorical data were presented as frequency (n) and percentile value (%), and quantitative data as median ± standard deviation. The significance of changes in US strain-ratio (elastography) scores within the groups was examined with the Wilcoxon Signed Rank test. Comparisons of the same measurements between groups were made using the Mann-Whitney U test. All analyses were conducted using SPSS v. 23 software (IBM Corp., Armonk, NY, USA).

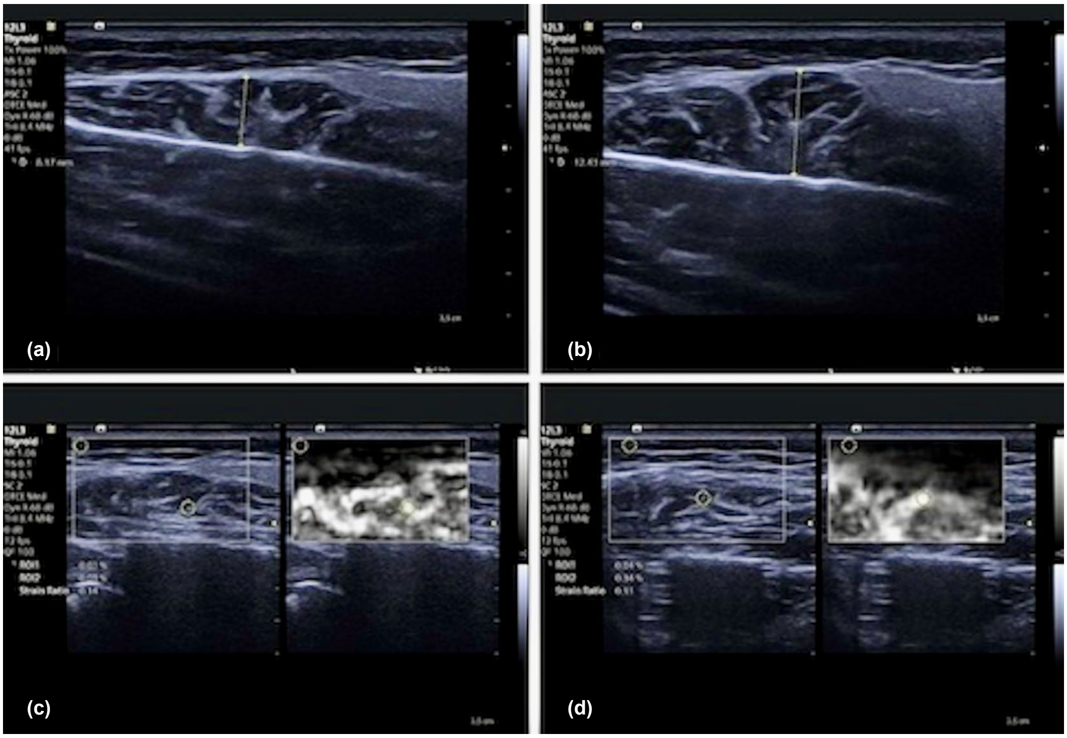

Figure 1. Ultrasonographic images of the masseter muscle thickness in relaxed **(a)** and contracted **(b)** positions. Strain-type sonography of the masseter muscle in relaxed **(c)** and contracted **(d)** positions.

RESULTS

The study included a sample of 40 patients, with 28 receiving NPT and 12 undergoing occlusal splint therapy. There were no significant differences in age, gender, or presence of chronic diseases between the two groups. Demographic data for all patients are provided in Table 1. Initially, the groups were evenly distributed.

Statistically significant differences were observed in parameters B and C exclusively in the NPT group (p=0.001 and p=0.011, respectively), while parameters D and H demonstrated differences in both groups (NPT group: right side p<0.001, left side p=0.007; splint group: right side p=0.005, left side p=0.012). Additionally, parameter F exhibited statistically significant differences across all patients (p=0.014). A detailed breakdown of the values can be found in Table 2.

In the intergroup statistical analysis, no statistically significant differences were found between the two groups in terms of elastography measurement values. These values are presented in Table 3.

No subjective evaluations were reported for the NPT group. The only side effects noted were bruising at certain injection sites. Conversely, the occlusal splint therapy group reported numerous issues related to sleeping with an open mouth.

DISCUSSION

This research examined the effectiveness of 5% DNP and oc-

Table 1. Patient characteristics

	All (n=40)	Prolotherapy Group (n=28)	Occlusal Splint Group (n=12)	p
Age (years) (Mean ± Standard Deviation)				
(Minimum-Maximum)	29.88±8.2	29.50±7.8	30.0±9.3	1.000
	(18-40)	(18-40)	(18-40)	
Gender (Female/Male, n)				
(Female/Male, %)	32/8	23/5	9/3	0.677
	80/20	82.1/17.9	75.0/25.0	

n: Number; %: Percentage.

Table 2. In-group ultrasonography (USG) measurement values

USG	Group	Before	After	p Value
A	All	8.1 (4.5-10.8)	7.9 (5.1-16.4)	0.979
	Prolotherapy	7.6 (5.6-10.7)	7.9 (5.1-16.4)	0.838
	Occlusal Splint	8.6 (4.5-10.8)	7.9 (5.1-10.2)	0.583
B	All	0.1 (0.0-0.6)	0.1 (0.0-0.4)	0.011*
	Prolotherapy	0.1 (0.0-0.6)	0.1 (0.0-0.3)	0.001*
	Occlusal Splint	0.1 (0.1-0.2)	0.1 (0.0-0.4)	0.964
C	All	10.7 (6.2-16.7)	11.6 (7.9-21.8)	0.003*
	Prolotherapy	10.7 (7.6-16.7)	11.6 (8.7-21.8)	0.011*
	Occlusal Splint	11.0 (6.2-14.8)	11.6 (7.9-14.1)	0.155
D	All	0.1 (0.0-0.5)	0.1 (0.0-0.2)	0.001*
	Prolotherapy	0.1 (0.0-0.5)	0.1 (0.0-0.2)	0.007*
	Occlusal Splint	0.1 (0.0-0.3)	0.1 (0.0-0.2)	0.012*
E	All	8.0 (4.8-13.2)	8.4 (4.2-13.3)	0.595
	Prolotherapy	8.0 (4.8-13.2)	8.1 (4.2-13.3)	0.716
	Occlusal Splint	8.2 (5.5-11.1)	9.0 (5.1-10.9)	0.638
F	All	0.2 (0.0-0.6)	0.1 (0.0-0.5)	0.014*
	Prolotherapy	0.2 (0.1-0.6)	0.1 (0.0-0.5)	0.063
	Occlusal Splint	0.1 (0.0-0.3)	0.1 (0.0-0.3)	0.074
G	All	11.8 (7.0-18.4)	11.9 (7.0-21.7)	0.448
	Prolotherapy	12.0 (7.1-18.4)	11.9 (7.0-21.7)	0.608
	Occlusal Splint	10.8 (7.0-16.4)	11.9 (8.5-15.0)	0.638
H	All	0.1 (0.0-0.5)	0.0 (0.0-0.4)	<0.001*
	Prolotherapy	0.1 (0.0-0.5)	0.0 (0.0-0.4)	<0.001*
	Occlusal Splint	0.1 (0.0-0.2)	0.0 (0.0-0.2)	0.005*

*p<0.05. A: Thickness of left musculus massetericus in resting position; B: Strain ratio of left musculus massetericus in resting position; C: Thickness of right musculus massetericus in contracted position; D: Strain ratio of left musculus massetericus in contracted position; E: Thickness of right musculus massetericus in resting position; F: Strain ratio of right musculus massetericus in resting position; G: Thickness of right musculus massetericus in contracted position; H: Strain ratio of right musculus massetericus in contracted position.

clusal splint use in treating bruxism, as well as the US evaluation results of this comparison. The results indicated that both treatments were successful and produced comparable levels of efficacy. This is the first study to explore the use of 5% DNP in the treatment of bruxism.

Bruxism can affect the nerves that control jaw movement, particularly the third branch of the trigeminal nerve (V3 nerve), which innervates the masticatory muscles facilitating jaw movement.[15] Bruxism can disrupt the coordination between the V3 nerve and jaw muscles, resulting in excessive tension in the jaw muscles and headaches.[16] However, nerve involvement in bruxism may vary among individuals, and nerve inflammation may not always be apparent. Bruxism frequently correlates with hyperactivity of the jaw muscles. The study aimed to improve conditions related to the buccal and inferior alveolar nerve branches, which are part of the mandibular branch of the trigeminal nerve. Neuroprolotherapy is a method used to treat neurogenic inflammation.[7,14] Neuroprolotherapy was employed as a form of reverse mechanism for healing, starting from the tip and gradually moving towards the central area.[7,14] It was hypothesized that with the method of application used in this study, healing would occur for inflammation that developed from the superficial ends of the buccal and inferior alveolar nerves, followed by the mandibular nerve and trigeminal nerve. As an alternative perspective, some studies suggest that 5% dextrose provides up to 48 hours of pain relief.[17,18] However, in our study, the reduction in pain lasted longer than expected, suggesting that the effects cannot be attributed solely to the analgesic properties of 5% dextrose. Another study demonstrated that 5% dextrose increases the gene expression of angiogenic (PDGF-A, PDGF-B, VEGF, and IGF) and apoptotic (CASP 3 and 8) factors in human fibroblast cell cultures.[19] Previous limited studies on neural prolotherapy widely accept that the use of a 5% dextrose solution results in decreased neuropeptide re-

Table 3. Intergroup elastography measurement values

	Prolotherapy	Occlusal Splint	p Value
A			
Before	7.6 (5.6-10.7)	8.6 (4.5-10.8)	0.260
After	7.9 (5.1-16.4)	7.9 (5.1-10.2)	0.896
B			
Before	0.1 (0.0-0.6)	0.1 (0.1-0.2)	0.760
After	0.1 (0.0-0.3)	0.1 (0.0-0.4)	0.373
C			
Before	10.7 (7.6-16.7)	11.0 (6.2-14.8)	0.942
After	11.6 (8.7-21.8)	11.6 (7.9-14.1)	0.965
D			
Before	0.1 (0.0-0.5)	0.1 (0.0-0.3)	0.805
After	0.1 (0.0-0.2)	0.1 (0.0-0.2)	0.919
E			
Before	8.0 (4.8-13.2)	8.2 (5.5-11.1)	0.550
After	8.1 (4.2-13.3)	9.0 (5.1-10.9)	0.138
F			
Before	0.2 (0.1-0.6)	0.1 (0.0-0.3)	0.405
After	0.1 (0.0-0.5)	0.1 (0.0-0.3)	0.457
G			
Before	12.0 (7.1-18.4)	10.8 (7.0-16.4)	0.716
After	11.9 (7.0-21.7)	11.9 (8.5-15.0)	0.631
H			
Before	0.1 (0.0-0.5)	0.1 (0.0-0.2)	0.163
After	0.0 (0.0-0.4)	0.0 (0.0-0.2)	0.873

A: Thickness of the left musculus massetericus in resting position; B: Strain ratio of the left musculus massetericus in resting position; C: Thickness of the right musculus massetericus in contracted position; D: Strain ratio of the left musculus massetericus in contracted position; E: Thickness of the right musculus massetericus in resting position; F: Strain ratio of the right musculus massetericus in resting position; G: Thickness of the right musculus massetericus in contracted position; H: Strain ratio of the right musculus massetericus in contracted position.

lease.[20] Consequently, it has been reported that 5% dextrose inhibits the transient receptor potential vanilloid-1 (TRPV1) receptor, which is involved in the pain response. This leads to a reduction in proinflammatory neuropeptides and thus suppresses neurogenic inflammation.[7,14,21] The reduction in nerve swelling facilitates the restoration of various growth factors to normal levels, promoting healing and reducing pain.[14,20] In our study, the activation of regeneration mechanisms by 5% dextrose may have supported the healing process through this mechanism of action. As a result of these interventions, it can be concluded that there was a relaxation of the buccal muscle and a decrease in toothaches and TMJ pain observed in this study. Additionally, some patients reported a reduction in headaches, which may be due to the involvement of the frontal or ophthalmic branches of the trigeminal nerve, or previous healing of the trigeminal nerve.

No significant changes were observed in measurements A, E, F, and G before and after treatment in both groups during the US evaluation. The resting thickness of the masseter muscle, both on the right and left sides, as well as the thickness in the contracted state on the right side, did not show significant differences before and after both treatment methods. Similarly, no significant difference was observed in the pre- and post-treatment measurements of the strain ratio in the contracted state of the right masseter muscle for both treatment methods.

These measurements reflect the muscle values at rest, except for G. No change was expected in the resting muscle, and the results were as expected. However, a significant difference was observed in the pre- and post-treatment measurements of the strain ratio in the resting state of the left masseter muscle, particularly with NPT treatment, indicating a more pronounced effect compared to the other treatment method.

The right musculus massetericus in the contracted position, represented by measurement G, did not show significant changes, possibly because the right side is usually dominant. The study is limited by the fact that the dominant side of the participants was not examined. It was observed that the strain ratio of the masseter muscle in the contracted state decreased on both the right and left sides after both treatment methods. As anticipated, these results are indicative of success for both treatments. Furthermore, the NPT group demonstrated a reduction in the strain ratio of the left musculus massetericus in the resting position (B), and an increase in the thickness of the left musculus massetericus in the contracted position (C). The decrease in strain ratio of the left musculus massetericus in the resting position is a favorable outcome of the treatment. However, no changes were observed in the strain ratio (F) on the right side with either treatment. In the contracted position, the thickness of the left musculus massetericus (C) increased in the NPT group, whereas the value for the right side (G) remained unchanged in both groups. The strengthening of the muscle after the cessation of pain may have resulted in healthy hypertrophy. A limitation of the study is the lack of evaluation of the dominant side. Additionally, the small size of the occlusal-splint group may have impacted the findings.

Patients receiving occlusal-splint treatment reported challenges with utilizing the aligners daily. At each visit, patients reported that the night guard caused their mouth to remain open while sleeping, leading to dryness and a sore throat upon waking. Consequently, it proved challenging to continue using it. Finding suitable patients for the occlusal-splint group proved difficult as it needed to be produced and administered after addressing all existing dental problems. It was observed that scheduling appointments with relevant clinics and adhering to these appointment dates to complete their treatments posed a challenge for some patients. Azlag Pekince et al. utilized US imaging to detect muscle spasm points in patients with TMJ dysfunction, identifying certain trigger points that were otherwise inaccessible through clinical examination.[11] Orhan et al. demonstrated the promising potential of an artificial intelligence system for analyzing ultrasound images, particularly in the automated measurement of masseter muscle thickness.[22] Until now, ultrasound imaging has been widely used in the medical field for the head and neck region, and its use in dentistry has gained prominence in recent years. Its prevalence in assessing soft tissue disorders has increased, and the integration of artificial intelligence is now being considered for advanced treatments. In a study similar to the current one, the evaluation of masseter muscle elastography and thickness was conducted using ultrasound shear-wave elastography before and after splint therapy in bruxism patients. A significant difference was observed in the resting state.[23] In the current study, two different treatments were assessed through pre- and post-treatment US evaluations. Unlike the previous study, a significant difference in strain ratio was observed only in the left masseter muscle during the resting state among those who underwent NPT treatment. Kalluvalappil et al. conducted an assessment of masseter muscle thickness in patients with oral submucous fibrosis using ultrasound imaging. They found a significant difference in thickness based on the ultrasound results.[24] As the number of studies utilizing US in dental research increases, certain standards will be established for specific diseases and treatment outcomes. With no harmful side effects such as radiation, this adjunctive examination method is expected to contribute to easier and earlier diagnosis of some diseases in the oral region. Additionally, it is anticipated that more objective criteria will be established for evaluating the effectiveness of certain treatments.

Limitations

Firstly, a larger sample size would be preferable to enhance the robustness of these findings. Secondly, the dominant side of patients was not recorded. This study is subject to these two key limitations. However, it is notable for its contribution to the literature, being the first to provide information on this subject.

CONCLUSION

There are many underlying causes of bruxism, and it cannot be cured with a single treatment. This study shows that 5% DNP is an effective treatment similar to an occlusal splint. It can be used to treat bruxism effectively. In addition, 5% DNP may be preferred because it is inexpensive, easily accessible, and has few side effects. Objectively visualizing changes in the masseter muscle through USG reveals clear results in the context of bruxism. It appears to be an effective imaging method for evaluating treatment and planning further steps based on the assessment of treatment outcomes.

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REFERENCES

1. Manfredini D, Ahlberg J, Aarab G, Bender S, Bracci A, Cistulli PA, et al. Standardised tool for the assessment of bruxism. J Oral Rehabil 2024;51:29–58. [CrossRef]
2. Bulanda S, Ilczuk-Rypuła D, Nitecka-Buchta A, Nowak Z, Baron S, Postek-Stefańska L. Sleep bruxism in children: etiology, diagnosis, and treatment—a literature review. Int J Environ Res Public Health

2021;18:9544. [CrossRef]
3. Fernandez-Nunez T, Amghar-Maach S, Gay-Escoda C. Efficacy of botulinum toxin in the treatment of bruxism: Systematic review. Med Oral Patol Oral Cir Bucal 2019;24:e416–24. [CrossRef]
4. Amorim CSM, Espirito Santo AS, Sommer M, Marques AP. Effect of physical therapy in bruxism treatment: a systematic review. J Manipulative Physiol Ther 2018;41:389–404. [CrossRef]
5. Reeves KD, Sit RWS, Rabago DP. Dextrose prolotherapy: a narrative review of basic science, clinical research, and best treatment recommendations. Phys Med Rehabil Clin N Am 2016;27:783–823. [CrossRef]
6. Zhu M, Rabago D, Chung VC, Reeves KD, Wong SYS, Sit RWS. Effects of hypertonic dextrose ınjection (prolotherapy) in lateral elbow tendinosis: a systematic review and meta-analysis. Arch Phys Med Rehabil 2022;103:2209–18. [CrossRef]
7. Reeves KD, Lyftogt J. Prolotherapy. In: Waldman SD, editor. Pain Management. 2nd edition. Philadelphia: Saunders (Elsevier); 2011. p. 1027–44. [CrossRef]
8. Solmaz I, Orscelik A. Features and Clinical Effectiveness of the Regenerative Injection Treatments: Prolotherapy and Platelet-Rich Plasma for Musculoskeletal Pain Management. In: From Conventional to Innovative Approaches for Pain Treatment. 1st edition. IntechOpen; 2019. [CrossRef]
9. Solmaz I, Orscelik A, Koroglu O. Modified prolotherapy by 5% dextrose: Two years experiences of a traditional and complementary medicine practice center in Turkey. J Back Musculoskelet Rehabil 2022;35:763–70.
10. Jan Kersschot. Glucopuncture: A novel injection technique for medically underserved populations. World J Adv Res Rev 2022;16:001–4. [CrossRef]
11. Azlag Pekince K, Caglayan F, Pekince A. Imaging of masseter muscle spasms by ultrasonography: a preliminary study. Oral Radiol 2020;36:85–8. [CrossRef]
12. Sit RWS, Reeves KD, Zhong CC, Wong CHL, Wang B, Chung VC, et al. Efficacy of hypertonic dextrose injection (prolotherapy) in temporomandibular joint dysfunction: a systematic review and meta-analysis. Sci Rep 2021;11:14638. [CrossRef]
13. Saba EKA. Efficacy of neural prolotherapy in treatment of meralgia paresthetica: a case series. Egypt J Neurosurg 2022;37:20. [CrossRef]
14. Saba EKA. Efficacy of neural prolotherapy versus local corticosteroid soft tissue injection for treatment of chronic anserine bursitis: a prospective randomized clinical trial. Ain-Shams J Anesthesiol 2022;14:3. [CrossRef]
15. Sivam S, Chen P. Anatomy, occlusal contact relations and mandibular movements. StatPearls, 2023.
16. Wu Y, Lan Y, Mao J, Shen J, Kang T, Xie Z. The interaction between the nervous system and the stomatognathic system: from development to diseases. Int J Oral Sci 2023;15:34. [CrossRef]
17. Maniquis-Smigel L, Dean Reeves K, Jeffrey Rosen H, Lyftogt J, Graham-Coleman C, Cheng AL, et al. Short term analgesic effects of 5% dextrose epidural ınjections for chronic low back pain: a randomized controlled trial. Anesthesiol Pain Med 2016;7:e42550. [CrossRef]
18. Maniquis-Smigel L, Reeves KD, Rosen HJ, Lyftogt J, Graham-Coleman C, Cheng A-L, et al. Analgesic effect and potential cumulative benefit from caudal epidural D5W in consecutive participants with chronic low-back and buttock/leg pain. J Altern Complement Med 2018;24:1189–96.
19. Güran Ş, Çoban ZD, Karasimav Ö, Demirhan S, Karaağaç N, Örsçelik A, et al. Dextrose solution used for prolotherapy decreases cell viability and increases gene expressions of angiogenic and apopitotic factors. Gulhane Med J 2018;60:42. [CrossRef]
20. Weglein A. Neural prolotherapy. J Prolotherapy 2011;3:639–43.
21. Rezasoltani Z, Taheri M, Kazempour Mofrad M, Mohajerani S. Periarticular dextrose prolotherapy instead of intra-articular injection for pain and functional improvement in knee osteoarthritis. J Pain Res 2017;10:1179–87. [CrossRef]
22. Orhan K, Yazici G, Kolsuz ME, Kafa N, Bayrakdar IS, Çelik Ö. An artificial intelligence hypothetical approach for masseter muscle segmentation on ultrasonography in patients with bruxism. J Adv Oral Res 2021;12:206–13. [CrossRef]
23. Yalcin ED, Aslan Ozturk EM. Ultrasonographic evaluation of the effect of splint therapy on masseter muscle and blood flow in patients with bruxism. CRANIO® 2022;1–9. [CrossRef]
24. Kalluvalappil A, Balan A, Chandrabose T, Venugopal M, Jacob J, Ramachandran S. Comparative ultrasonographic evaluation of the masseter muscle in patients with and without oral submucous fibrosis. J Indian Acad Oral Med Radiol 2023;35:75. [CrossRef]

ORİJİNAL ÇALIŞMA - *ÖZ*

Oklüzal travmada dekstroz nöroproloterapisi ve oklüzal splint tedavisi sonuçları: Ultrason görüntüleme yoluyla değerlendirme

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AMAÇ: Günümüzde bireylerde okluzal travma çok sık rastlanılan bir olgu haline gelmiştir. Temel olarak kaynağı bruksizmdir. Bruksizm, gündüz veya uyku sırasında diş sıkma ve gıcırdatma gibi alışılmadık aktiviteleri içerir. Hipotez, %5 dekstroz nöroproloterapi ile tetik noktaları ve etkilenen sinirlerin iyileşeceği ve ağrının ortadan kaldırılmasıyla kasın rahatlayacağı yönündedir.

GEREÇ VE YÖNTEM: Bu çalışma, bruksizm tedavisinde okluzal splint ve %5 dekstroz nöroproloterapi kullanımının kısa vadeli etkilerini Ultrasonografi ile karşılaştırmayı amaçlamıştır. Hastalar rastgele iki gruba ayrıldı; dekstroz nöroproloterapi ve okluzal splint. dekstroz nöroproloterapi yöntemi ile %5 dekstroz bir hafta arayla 3 kez uygulandı. İkinci grupta her iki çene için yüksek viskoziteli geri dönüşümsüz hidrokolloid ölçü maddesi kullanılarak ölçüler alındı. Üst çeneye uyacak şekilde özelleştirilmiş bir okluzal splint yapıldı. Hastalar, tedavi öncesi ve tedaviden 3 ay sonra ultrasonografi kullanılarak masseter kasının kalınlık ve elastografi(strain oranı) açısından değerlendirildi.

BULGULAR: Tüm ölçümler için iki grup arasında istatistiksel olarak anlamlı bir fark bulunmamıştır. Nöroproloterapi grubunda yalnızca sol masseter kasının dinlenme pozisyonundaki strain oranı ve kasılı pozisyondaki kalınlığında istatistiksel olarak anlamlı fark gözlenmiştir (sırasıyla p=0.001, p=0.011). Her iki grupta da kasılı haldeki masseter kasının her iki tarafındaki strain oranında anlamlı fark gösterilmiştir (nöroproloterapi grubu; sağ taraf p<0.001, sol p=0.007, splint grubu; sağ taraf p=0.005, sol p=0.012).

SONUÇ: Bu çalışma, %5 dekstroz nöroproloterapinin okluzal splint ile benzer şekilde etkili bir tedavi olduğunu göstermektedir. Ultrasonografi kullanılarak masseter kasındaki değişikliklerin objektif olarak görselleştirilmesi, okluzal travma ve bruksizm bağlamında net sonuçlar ortaya koymaktadır.

Anahtar sözcükler: Bruksizm; nöroproloterapi; okluzal splint; ultrasonografi.

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