

## Ozonotherapy as an Alternative to Pain Treatment in Temporomandibular Disorders

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### Abstract

**Introduction:** The temporomandibular disorders are very frequent; few studies exist that reflect the effectiveness of the ozone application intraarticular in the temporomandibular joint.

**Purpose:** To evaluate the remission time of pain in the studied patients after the ozone therapy application.

**Material and Methods:** An intervention study was realized in patients of the International Centre of Investigations of Ozone in La Havana, Cuba. Ozone (O<sup>3</sup>) was applied with the OZOMED Plus equipment. Ozone was applied intraarticular for ten sections 3 mg/L for a volume of 3 ml equivalent 0.03 mg in one bilateral section. Also combined with a rectal application at a dose of 30 to 40 mg / L for a volume of 200 ml per 20 continuous sections (daily).

**Results:** The patient with pain (100%) remitted before the ozone's fourth application. The patient of the oral opening limitation (100%) relaxed in intensity continued of mandibular deflection and deviation.

**Conclusions:** The intra-articular and rectal is a safe method for pain relief in the Temporomandibular Disorder and remitted before the fourth treatment session.

**Keywords:** Ozone; Temporomandibular Disorder Treatment; Ozonotherapy intraarticular

### Introduction

The stomatognathic system is an integrated and coordinated morphofunctional unit; constituted by the set of skeletal, muscular, angiological, nervous, glandular, dental and articular structures, such as the Temporomandibular Joint (TMJ), is one of the most complex joints in the body, which allows the hinge and sliding movement of the jaw in a plane [1,2].

The earliest references to the Temporomandibular Joint come from Egypt, 3000 years B.C, mentioning the disorders it produced. But it was not until the early 1930s that the pathological altera-

tions of the TMJ became important when Good Friend published his original work in 1933; followed shortly thereafter by Costen's widely circulated 1934 study, which associated cranial and atrial symptoms with joint disorders, thus defining the syndrome that bears his name. Later Bell in 1982 suggested the term Temporomandibular Disorders, which was gaining popularity to this day [3-5].

Temporomandibular Disorders are all functional alterations that can appear in the masticatory system due to attacks on its elements, which leads to qualitative and quantitative changes. The

most common symptoms and signs are chewing pain, headache, trismus, crepitus, limitation, and deviation of the mouth opening [6,7].

Temporomandibular Disorders have a multifactorial etiology; classically, local causes such as malocclusions, orthodontic treatments, occlusal disharmonies, parafunctional or general habits such as systemic diseases, psychological factors such as anxiety, depression, stress are described, which play an important role in the emergence and maintenance of these disorders, also there are trauma, sleep disorders, and even genetic factors; giving greater significance to occlusal, psychological factors and combinations of both [8-11].

Some studies suggest that this disorder is experienced by at least a third of the world population, different studies carried out throughout Cuba reflect similar figures, such as in Havana in In 2007, an investigation carried out on people aged 15 years and over showed that Temporomandibular Disorders appeared in 31.89% of those examined as a symptom and in 47.33% as a sign. Just as in 2009 it was evidenced in Holguín, that 32.6% of the adolescents studied, with permanent dentition without dental absences, presented untreated Angle Classification malocclusions, suffered from Temporomandibular Disorders [10-13].

Another study carried out on boxing athletes of the Cuban national team revealed that more than half had TMJ dysfunction [14].

These disorders are highly represented in the population, where the majority of those affected require some treatment throughout their lives. Conventional treatments used to treat these disorders are physiotherapy, non-steroidal anti-inflammatory drugs, analgesics, muscle relaxants, arthrocentesis, surgical treatments such as discectomy, disc replacement, arthroplasty, arthroscopy and ozone therapy that has obtained favorable results [7].

Medical ozone ( $O^3$ ) is a mixture (95%  $O^2$  and 5%  $O^3$ ) used in various concentrations and administered by different routes. Ozone therapy consists of the application of a mixture of medical oxygen with ozone; the mixture must be produced on-site for each application, and there will never be more than 5% ozone in it. Ozone regulates cellular oxidative stress, helping to strengthen antioxidant factors and combat free radicals [15,16].

The biological effects of ozone have been used in general medicine for many years to kill bacteria, fungi, inactivate viruses, and control bleeding. It was discovered in 1840 by the chemist Christian Frederick Schonbein, at the University of Basel in Switzerland, and was first used in medicine in 1870 by Landler. However, only until 1932 was it studied in the scientific community. Despite the fact that its application in medicine originated from the end of the 19<sup>th</sup> century, studies on its use in dentistry have been reported until a few years ago [17,18].

Ozone therapy is a therapy that is currently being widely used due to the advantages it offers in the cost-benefit system since it is a gas that is applied to the joint, which is the result of applying an electric shock to it, oxygen ( $O^2$ ) is converting it into ( $O^3$ ) using specific equipment. Although there are few studies of this technique in TMJ the authors proposed to reflect the results of the application of this therapy in the Ozone consultation of the International Research Center of the Ozone. In which we collaborate and actively participate in research. The aim of this study was to determine the time of pain remission in the Temporomandibular Joint after the application of Ozone.

### Methodological design

A therapeutic intervention study was carried out in patients treated for Temporomandibular Joint Disorders at the International Ozone Research Center, Havana, Cuba. The universe was made up of 50 patients who came to the consultation for Temporomandibular Joint pain. We worked with the entire universe meeting the following inclusion and exclusion criteria.

### Inclusion criteria

All patients of legal age who wish to participate in the study by signing the informed consent. All the patients that come to the consultation for the pain of the Temporomandibular Joint. Patients referred from the second level of care that did not decrease pain with conventional treatments. Only patients with non-degenerative inflammatory processes were included.

### Exclusion criteria

Patients who are medicated with steroidal and non-steroidal anti-inflammatory drugs at the time of ozone application. Patients with a history of generalized osteoarthritis (osteoarthrosis-osteoarthritis) or other systemic diseases that influences the Tempo-

mandibular Joint, pregnancy, breastfeeding, exposed to chemotherapy or radiotherapy, treatment with large doses of vitamin A or E, patients taking allopurinol. Patients who discontinue treatment before completing the 10 intra-articular sections and 20 rectally.

The necessary information was obtained using the interrogation, the physical examination and magnetic resonance of temporomandibular joint. The physical examination was performed in a chair, under natural light and using a flat oral mirror to correctly examine the integrity of the dental arches and a stethoscope to listen for joint noise.

To differentiate articular pain from myogenic, a physical examination was performed with static and functional palpation of the Masseter, Temporal, Occipital, Suprahyoid, Trapezius muscles, and the functional mandibular resistance examination to see Pterygoids and Masseters. The TMJ region was also palpated bimanual in order to differentiate pain in the TMJ region from pure muscle pain. Thus, patients with pain in the joint region can be defined.

Ozone (O<sup>3</sup>) was applied with the OZOMED Plus equipment, which consists of a calibrating table that determines the appropriate concentration according to intensity, applying as follows: The gas was loaded into a hypodermic syringe with needle # 27, in an amount of 3 mg/L at a volume of 3 ml for a dose of 0.03 mg in one application for each side, applied bilaterally.

Intra-articular was applied in the region corresponding to the TMJ with the mouth open behind the temporal articular tubercle in the region located between the tragus and the articular tubercle. Inserting needle # 27 to a depth of 2 cm. The number of intra-articular applications was 10 sections with a frequency per week (always on Mondays) as an interval parameter. Also combined with a rectal application at a dose of 30 to 40 mg/L for a volume of 200 ml per 20 continuous sections (daily) with the aim of potentiating its effect. Valuing the symptoms and signs of the patient until the end of treatment.

In order to preserve the ethical principles of the research and as it is a direct action study on humans, informed consent was obtained from the patients before carrying out the study, in order to be able to decide if they were part of the I study or not, requesting prior authorization from the center's teaching and research department, to be able to intervene in it.

Results

Age	TMJ Pain	Joint Noise	Mouth opening limitation	Mandibular Deflection	Mandibular deviation
	No (%)	No (%)	No (%)	No (%)	No (%)
20-29	3 (6%)	0 (0%)	3 (6%)	0 (0%)	1 (2%)
30-39	16 (32%)	5 (10%)	14 (28%)	8 (16%)	4 (8%)
40-49	19 (38%)	7 (14%)	15 (30%)	5 (10%)	3 (6%)
50-59	8 (16%)	8 (16%)	8 (16%)	3 (6%)	0 (0%)
60-70	4 (8%)	3 (6%)	2 (4%)	1 (2%)	2 (4%)
Total	50 (100%)	23 (46%)	42 (84%)	17 (34%)	10 (20%)

Table 1: Signs and symptoms of temporomandibular disorders before ozone application.

Table 1 shown that pain was the most relevant symptom with (100%) of the examined patients, as well as the limitation of mouth opening was significant with (84%).

Age	2 <sup>nd</sup> application	3 <sup>rd</sup> application	4 <sup>th</sup> application	Total
	No (%)	No (%)	No (%)	No (%)
20-29	2 (4%)	1 (2%)	0 (0%)	3 (6%)
30-39	0 (0%)	7 (14%)	9 (18%)	16 (32%)
40-49	1 (2%)	12 (24%)	6 (12%)	19 (38%)
50-59	0 (0%)	5 (10%)	3 (6%)	8 (16%)
60-70	0 (0%)	3 (6%)	1 (2%)	4 (8%)
Total	3 (6%)	28 (56%)	19 (38%)	50 (100%)

Table 2: Distribution of patients according to the time of remission of the pain of the Temporomandibular Joint by consultation of the application of intraarticular ozone.

Table 2 shown that in the first session there was no change in the variables and from the third session the highest percentage of remissions is evident, all referring in the fourth session for a (100%) pain-free, due to what is not included from the fifth session onwards.

Table 3 shows the remission of (100%) of the patients with limited mouth opening, followed on a smaller scale by the variables of

Signs	2 <sup>nd</sup> application	3 <sup>rd</sup> application	4 <sup>th</sup> application	Total
	No (%)	No (%)	No (%)	No (%)
Mouth opening limitation	2 (4%)	28 (56%)	12 (24%)	42 (84%)
Mandibular Deflection	0 (0%)	1 (2%)	1 (2%)	2 (4%)
Mandibular Deviation	0 (0%)	1 (2%)	0 (0%)	1 (2%)

**Table 3:** Distribution of patients by signs of Temporomandibular Joint Disorders according to remission time.

deflection and deviation. Joint noise did not undergo any change, so it is not included in the table.

**Discussion**

The use of ozone in medicine results from the various actions that it causes, such as immunostimulation, analgesic, anti-inflammatory action by the inhibition of prostaglandins, increasing the release of proinflammatory cytokine antagonists, anti-hypoxia and antimicrobial, bioenergetic and detoxification. Biokinetics, which is the activation of carbohydrate, protein, and lipid metabolism, among others, potentiates the healing process. Currently, ozonated oil is used very frequently in dental consultations, which has shown great germicidal power, being useful in the treatment of those diseases of the oral cavity with great bacterial, viral and fungal compromise [14,18-20].

There are articles published in various impact journals referring to the administration of epidural ozone in combination with intradiscal and paravertebral applications in the treatment of pain due to herniated disc, in addition, there are records of its use for the treatment of teeth whitening for aesthetic purposes but it has the disadvantage that in very high concentrations ozone can be highly toxic to the person, cause vascular ischemia and even hurt at the time of application. But in addition to its complications, uses have been described in retinitis pigmentosa, skin diseases, myofascial pain, carpal tunnel syndrome, tendinitis, joint pathologies, where TMJ is included [14,15,21,22].

Recent studies estimate that there are more than 26,000 medical experts in ozonotherapy in the world. They are mentioning

around 10 million patients are treated annually [16,23]. Being used primarily as a starting point for treatments in the medical field, this treatment has been gradually developed over the last few years.

The treatment of Temporomandibular Disorders is very complex and in most cases requires multiple corrective and intervention actions. It was evidenced in the study that pain was the symptom present in all the patients studied, being highly significant that most of these had limited mouth opening and the age group most affected in terms of these two signs and symptoms was that between forty to forty-nine years old followed by age group fifty to fifty-nine. The pain may be related to the limitation of the oral opening, since the mandibular movements can be affected when there is pain, due to the functional limitation that this causes. They also suffered from signs of disorders of the Temporomandibular Joint to a lesser extent, such as joint noise and mandibular deviation or deflection at the time of mouth opening. Corresponding to studies carried out by different dentists in different countries [10,24-27], who found alterations such as snapping, crackling, deflection, deviation, and pain of the TMJ in the studied. Mainly this last symptom in relation to the limitation of the oral opening.

This is possible since in the Temporomandibular Joint there is a polypeptide called substance P that is an existing transmitter in some primary neurons, and is involved in the transmission of pain and has also been suggested to have a role in acute and chronic inflammations. It was even stated that the degree of inflammation could be related to the amount of substance P that the joint contains [24].

With regard to the application of intra-articular ozone in patients and the time of pain remission in the region of the Temporomandibular Joint per session, it was evident that in the first session there was no change and from the third session it is that Most of the referrals were evident in more than half of those studied. All of them were referring in the fourth application session, although it should be noted that the youngest of those studied in the age group of twenty to twenty-nine were the fastest to begin to show improvement from the second session. It could be due to the presence of a reparative capacity that young people have more than adults. Corresponding the results with a similar study carried out by Menéndez Pérez [7] at the Ozone Research Center, where they apply O<sup>3</sup> in the treatment of arthritis of the Temporomandibular Joint due to rheumatoid arthritis with intra-articular and systemic

ozone therapy. Obtaining a decrease in pain, trismus and clicking. The combined intra-articular and rectal ozone therapy is more efficient than intra-articular alone. Applying the gas with the same dose applied in our study, only the difference is that it was specifically applied in rheumatoid arthritis of the Temporomandibular Joint.

Also, another study carried out by the Gómez Butsmann [28] and Daif [27] reflects the effectiveness of ozone in pain relief, concluding that patients who received ozone took much fewer analgesic tablets than those who were not treated with it.

Thus, affirming that this therapy has an economic advantage in terms of cost-benefit since it reduces the consumption of analgesic and anti-inflammatory drugs by the patient regardless of the form and area of application.

Regarding the analysis of patients for signs of disorders of the Temporomandibular Joint according to remission time, it can be said that all patients with limited mouth opening were able to enjoy the elimination of this functional disability, following on a smaller scale the improvement in deflection and deviation. The articular noise did remain stable, so it is inferred that the limitation of the mouth opening was functional as it was related to the presence of pain in those studied, although the gas, due to its properties, could have mechanically favored the TMJ. a similar study carried out on the knee joint which states that patients with functional disorders due to pain in this joint after the application of O<sup>3</sup> significantly improved their function [29].

Although O<sup>3</sup> cannot act on triggers, it has a reparative effect on joint structures, being able to act on damage, reversing the consequences of the degradation produced by free radicals produced by different systemic diseases or local inflammatory processes [7].

The most important function of the stomatognathic system is chewing followed by swallowing. These functions having a close relationship with the Temporomandibular Joint [30].

We can also affirm that ozone applied intraarticular and rectally is a method for pain relief in the region of the Temporomandibular Joint region when applied with the doses reflected in the study. Therefore, we do not dare to affirm its effectiveness of treatment at other doses in the TMJ due to the lack of research. Nor is it intended

to leave the weight of the treatment in this therapy but to contribute to the scientific arsenal of the treatment of Temporomandibular Disorders.

## Conclusion

It is concluded that the signs and symptoms present in this study were pain accompanied by limitation of the mouth opening, followed by joint noise, deflection, and deviation. The pain remitted before the fourth application of ozone in the form of intra-articular and rectal gas to potentiate its effects. The same result was observed in the limitation of the mouth opening followed by deflection and mandibular deviation. Being applied intra-articular and rectal ozone a safe method for pain relief in the Temporomandibular Joint.

## Interest Conflict

The authors declare that we have no conflict of interest with any commercial house or medical institution and we do not receive financial support from any institution or organization.

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