

# Aesthetic and Functional Oral Rehabilitation with Occlusal Trays, Ultrasonotherapy and Tolperison Hydrochloride Treatment in Patients with Dysfunctional Syndrome of Stomatognathic System and Muscular Affection

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*Our study, a clinic experiment type, was developed on a sample of 77 patients, aged between 60 and 74 years, taken into study and investigated from an electromyographic point of view, which presented the affliction of muscular activity as a result of decreasing or increasing of muscular tonus, or as a result of muscular contraction alterations. We have applied: occlusal trays (28 days) in all of the patients, aerosols therapy in 28 (36.4%) patients and tolperison hydrochloride (50 mg x 3/day, 28 days) in 27 (35.06%) patients. Also, we have applied occlusal trays and tray to be protective with the composite restoration of patients. The effect of augmentation on the local metabolic processes, the analgesia of painful zones and muscular relaxation have positive effects on long and short term. After applications with aerosols, we recorded amelioration in all patients: the absence of pain and the substantial amelioration of pain perception. Conclusions. Physical kinetic therapeutic methods aim at muscular relaxation, the toning up or the decrease of muscular tonus, improvement in mandible functionality, improvement in functionality at the level of temporomandibular joints and improvement in local circulation. The tolperison hydrochloride treatment was used as symptomatic treatment for muscular relaxation with positive results.*

**Keywords:** public health dentistry, temporo-mandibular joint disorders (TMJD), esthetics restoration, prosthetic treatment, ultrasonotherapy, dysfunctional syndrome of stomatognathic system (SDSS), muscle affection, splints therapy procedures

The physical kinetic therapy is a branch of medicine that uses natural and artificial physical factors in therapeutic purpose [1]. The great number of these factors determined the dissemination between the special therapeutic branches depending on the agent used: kinetic therapy, massage therapy, ultrasonotherapy etc. The methods of physical kinetic therapy induce muscular relaxation and offers the possibility of muscular reconditioning with the establishment of new neural-muscular engrams and, implicitly, of new patterns of mandible dynamics, the aim of this study being the study of different methods of treatment through physical factors, the assessment of action and efficiency, along with the integration of these methods within a treatment algorithm that will, finally, lead to stomatognathic system and cephalic musculature equilibrium.

Also, the tolperison hydrochloride administration in patients having dysfunctional syndrome of stomatognathic system (SDSS) with muscular affection induce muscular relaxation and offers the possibility of muscular reconditioning.

The increased occurrence of muscular dysfunctions at the level of stomatognathic system [2], proved by the epidemiological studies constitutes the foundation for establishing mandatory applied physical kinetic therapy in the complex rehabilitation of stomatognathic system [3].

## Experimental part

### Motivation, purpose and objectives

The elaboration of the present study was motivated by the need of finding proof that would confirm the significant therapeutic effectiveness of tolperison hydrochloride administration and physical kinetic therapy in patients having dysfunctional syndrome of stomatognathic system (SDSS) with muscular affection. From this perspective, the purpose of the study was to highlight the therapeutic effectiveness of the aerosols, kinetic therapy, massage therapy, ultrasonotherapy and the tolperison hydrochloride (50mg x 3/ day) used for muscular relaxation, and revealing any possible correlations between the analysed parameters and the independent studied variables (age and gender).

Our study followed several specific objectives in order to accomplish the target aim:

- determination of therapeutic effectiveness using the average score method proposed by Carausu EM [4];
- testing the statistical significance of the differences between the analysed parameters.

## Experimental part

### Material and method

Between October 1<sup>st</sup> 2016 and May 1<sup>st</sup> 2018, a total of 91 persons were taken into study; the evaluation in the view of study's objectives was performed during the dental

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treatment, and also during the hospitalization. We have must a complex clinical and paraclinical examination [5] we decided the diagnosis [6] and after we establish the individual treatment plan [7].

Our study, a longitudinal clinic experiment type, was developed on a final sample of 77 (84.62%) patients, investigated from an electromyographic point of view, which presented the affliction of muscular activity as a result of decreasing or increasing of muscular tonus, or as a result of muscular contraction alterations of cephalic extremity muscles.

Gender distribution of this study batch included 45 women and 32 men, aged between 60 and 74 years, which presented clinical signs of muscular dysfunction, a decrease or an increase of muscular tonus, with a keen interest regarding the affliction of stomatognathic system and a heightened concern regarding the recuperation of the diminished functions. This alternative was deliberately selected, in order to avoid the drop-outs of patients from the participation in the study [8].

**Inclusion criteria** for the patients in our study were represented by the presence of muscular tonus and muscular contraction alterations, paraclinical and clinical distinguished based on electromyographic exam and on T-scan analysis [9]. Also, subjects were included which presented signs and symptoms of muscular dysfunction, such as: pain at the level of stomatognathic system and cephalic extremity, muscular hypertonia, muscular hypertrophy, limitation of mouth opening, and deviation of mandible from the medial line during the opening, fatigue of cephalic extremity muscles and functional alteration of stomatognathic system.

**The exclusion criteria** of the patients were represented by the presence of joint affliction [10], of the third molar pathology, osteoarthritis, neoplasm [3], patients who exhibited signs.

We have applied various methods of treatment, in single/or multiple therapy through physical factors, addressed to stomatognathic system and cephalic extremity, along with other systemic elements, as a result of interconnections established at systemic and over systemic level.

The tolperison hydrochloride ( $C_{16}H_{23}NO$ ) treatment is indicated in patients having dysfunctional syndrome of stomatognathic system (SDSS) with muscular affection (fig. 1). Tolperison hydrochloride is used for the symptomatic treatment of muscle spasticity. Tolperison hydrochloride is an oral, centrally acting muscle relaxant. It possesses a high affinity for nervous system tissue, reaching highest concentrations in brain stem, spinal cord and peripheral nerves. Based on existing clinical data, Tolperison hydrochloride is not sedating and does not interact with alcohol.

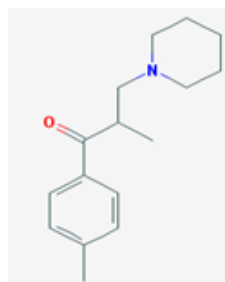


Fig. 1. Tolperison Hydrochloride- chemical formula

Our database was created using Microsoft Excel for Windows; the computer statistic processing was performed using SPSS 18.0 for Windows. The descriptive statistics module was used, which allowed the calculation of the main statistic indicators (mean value). Statistical significance tests (Pearson  $\chi^2$  test) were applied in order

to check the statistical significance of the noticed differences [11].

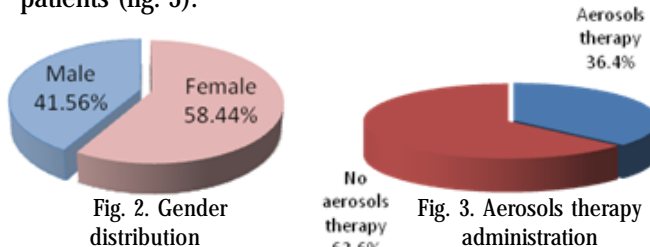
Ethical clearance for the study was obtained from the institutional ethical committee.

## Results and discussions

### General characteristics

Gender distribution of this study batch included 45 (58.44%) women and 32 (41.56%) men, aged between 60 and 74 years (fig. 2).

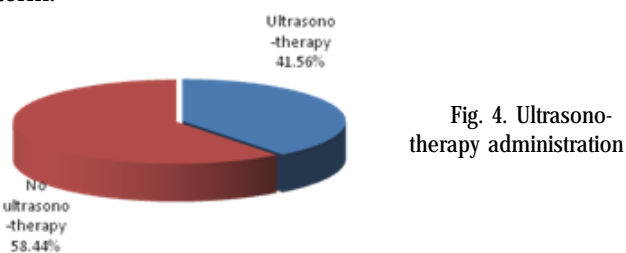
**Aerosols therapy** was administered in 28 (36.40%) patients (fig. 3).



After three applications with aerosols, we recorded amelioration in all patients: the absence of pain in 15 (19.48%) patients and the significant amelioration of pain perception were seen at 5 (6.49%) patients. We have observed the suppression of pain, and the duration of efficiency is frequently over 5 days. We observed no side effects.

In the treatment of muscular-joint disorders at the level of stomatognathic system we can use ultrasounds sources. Ultrasonic therapy was made through direct contact with the projector, which has an emission head of 10 mm, slowly moving in linear or circular movements on the treatment area, without exerting high pressure. Contact between the surface of the projector and the treated area is done anointing the skin with a thin layer of paraffin oil or ointment with analgesic and anti-inflammatory action. Treatment was done on limited surfaces of 10-30 mm<sup>2</sup> with relatively low intensity of 0.2-0.8 W/cm<sup>2</sup>, 15 sessions, every day or every two days.

In our study, **ultrasono-therapy** was administered in 32 (41.56%) patients (fig. 4); the augmentation on the local metabolic processes, the analgesia of painful zones and muscular relaxation has positive effects on short and long term.



The results at the level of batch study obtained following the evaluation and secondary to administration the ultrasono-therapy procedures were:

Table 1

Number of patients	Score (0-10 scale)
Total 32	-
5	8
5	7
11	6
8	5
3	4
Medium score	6.03 (60.30%)

We observed the alleviation of the pain, a good efficiency in increasing the muscular tonus and reducing the spasms, the duration of efficiency is frequently beyond 3 days, and the highest efficiency was recorded on the application of disjunctive low frequency current.

The *massage therapy* procedures were administered in 21 (27.30%) patients (fig. 5). Active or passive mobilization of cephalic extremity muscle is achieved through two known and widely used treatment techniques: massage therapy and physical therapy [12].

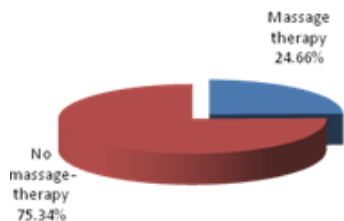


Fig. 5. The massage therapy procedures administration

The results at the level of batch study obtained following the evaluation and secondary to administering massage-therapy procedures were:

Number of patients	Score (scale of 0-10)
Total 21	-
8	9
8	8
4	7
1	6
Medium score	8.095 (80.95%)

Table 2

After massage therapy and three applications with laser, we recorded amelioration in all patients. We have observed the low level of pain, and the duration of efficiency is frequently over 5 days. We observed no side effects.

Also, the *splints therapy* [13] procedures were administered in 27 (35.06%) patients. The results obtained following the evaluation and secondary to administering procedures were :

Number of patients	Score (0-10 scale)
Total 27	-
2	8
17	7
8	6
Medium score	6.851 (68.51%)

Table 3

We observed the alleviation of the pain, a good efficiency and balanced the muscular tonus and reduce the spasms, the duration of efficiency is frequently beyond 10-12 days. The time of *occlusal trays* application [14] is about 28 days, in which patients will have some restrictions in terms of driving dynamics jaw and of course a drug therapy in order to remake the musculature equilibrium.

Also, in our study, we used the tolperison hydrochloride therapy, 28 days in association with splint therapy. This *muscular relaxation medication* was used in association with balneo-physical therapeutic methods because the results like said the literature are more improved and are different sorted by each patient. The tolperison hydrochloride therapy, 50 mg/day x 3 (morning, lunch and noon), 28 days, was applied in 27 (35.06%) patients, 20 of feminine gender and 7 masculine gender; 17 from urban and 10 rural area.

The clinical method to establish an objective qualification of the therapeutic effectiveness is the Souyleroy and col. classification as is shown in the following table:

Table 4

Efficiency on spasm	Good	2
	Medium	1
	None	0
Efficiency on muscle tone	Good	2
	Medium	1
	Nune	0
Length of efficiency	>3 days	2
	1-3 days	1
	<3 days	0
Side effects	Yes	0
	No	1
Evolution (after several coats)	Improvement	1
	Aggravation or no improvement	0
Pain	Complete removal	2
	Partial removal or improvement	1
	Lack of efficiency	0

The clinical results of investigation of the pain in association of the other associative symptoms before the muscular relaxation treatment with are shown in the table below:

No. patients	Score (scale of 0-10)
Total 27	-
7	7
3	6
4	5
13	4
Medium score	5.15 (51.5%)

Table 5

The results of the study at the level of the batch obtained from the evaluation after applying treatment with tolperison hydrochloride were as follows:

No. patients	Score (scale of 0-10)
Total 27	-
5	9
7	8
7	7
3	6
4	5
1	4
Medium score	7.11 (71.10%)

Table 6

Testing the statistical significance of the differences between before and after applying treatment with tolperison hydrochloride for the muscular relaxation treatment we found a significant clinical improvement ( $\chi^2 = 22.286$ , LD = 5,  $p=0.00046194$ ) in elderly patients.

We found that associating the treatment of the The aesthetics restorations and prosthetics treatment were restored and want their time tracking quantify treatment results.

The tolperison hydrochloride treatment has been used for the symptomatic treatment of spasticity and muscle spasm [15].

Physical-kinetic-therapy is a branch of medicine that uses natural and artificial physical factors in therapeutic purpose. The great number of these factors determined the dissemination between special therapeutic branches depending on the agent used: aerosols, kinetic therapy, massage therapy, ultrasonotherapy etc. The physical



kinetic therapy used in dental medicine represented an unknown and underappreciated domain. The systematization of these methods was accomplished in Iasi.

In dental medicine most of the therapeutic procedures have a curative (restorative) character, both morphologically and functionally, in the context of maintaining or restoring the biological and biomechanical equilibrium of the stomatognathic system. Systemic dishomeostasis, represented by cranio-mandibular malrelation, a complex clinical form, involves the disturbance of the balance between stomatological elements, which requires a profound and careful approach of all stages of treatment. Restoring the balance of the stomatognathic system requires a complex treatment. Whether the patient requires a relatively simple treatment consisting of the application of a single microprosthesis or a prosthesis on implants, the dentist's attention should primarily be directed towards preserving the static and dynamic cranio-mandibular relationships, or appropriate cranio-mandibular repositioning, when this is required.

All modern etiopathogenic theories incriminate stomatognathic system muscles in producing the dysfunction, regardless of the action of the causative agent, on systemic or over systemic level [16].

We have observed that the association between etiologic therapy and muscular relaxation treatment and the administration of laser therapy and/or aerosols possesses an increased efficiency, as compared to the implementation of laser therapy or aerosols in singular treatment, the pain is alleviated, the efficiency is high at 3 days and we have observed no side effect.

The efficiency of toning up methods is closely related to the period of administering the techniques, on short term, the alterations at the level of muscular tonus being difficult to observe, but clinical and, especially paraclinical evaluation, of the patients at 2, 3 and 6 months demonstrates the alteration of electromyographic values (the absence of electric activity at rest, normal electric activity in maximal intercuspidal position).

## Conclusions

We found that associating the treatment of the etiological therapy of muscular relaxation with physical-kinetic-therapeutic methods has increased efficiency in comparison with the use of physical-kinetic-therapeutic methods alone. Physical-kinetic-therapeutic methods aim at muscular relaxation, the toning up or the decrease of muscular tonus, improvement in mandible functionality, improvement in functionality at the level of temporomandibular joints and improvement in local circulation.

The establishment of stomatognathic system functions is based mainly on the neural-muscular activity that ensures the mandible static and dynamics, relaxation, re-equilibration, and functional re-education being mandatory for complex rehabilitation of stomatognathic system.

The engrave at the level of nervous system of new reflex images for a new coordination of mandibular movement and of postural position at the level of cephalic extremities is achieved by a series of facile techniques that are based on the use of new patterns of movement and their reiteration, under medical supervise, mandatory at the beginning of the treatment, but also with the direct involvement of patient and of his/her entourage in the therapy, once the methods were adequately learnt. The cognitive and volition level has a great importance in a successful therapy.

The tolperison hydrochloride treatment was used as symptomatic treatment for muscular relaxation with positive results.

Poly-therapies that associating the treatment of the etiological therapy of muscular relaxation with physical-kinetic-therapeutic methods has increased efficiency in comparison with the use of physical-kinetic-therapeutic methods alone.

## References

1. GREENE, C.S. (2010). American Association of Dental Research, Management of patients with TMDs: a new standard of care. *Int. J. Prosthodont*, 23 (3): 190-191.
2. CARAUSU, E.M.; DASCALU, C.G.; ZEGAN, G.; BURLEA, L.S.; LUPU, I.C.; ANTOHE, I. (2017). *Revista de Cercetare si Interventie Sociala (RCIS)*; **59**: 187-208.
3. CARAUSU, E.M.; CHECHERITĂ, L.E.; STAMATIN, O.; ALBU, A., *Rev.Chim.(Bucharest)*, **67**,no.9, 2016 p.1832
4. CHECHERITA, L.E.; REZUS, E.; LEON, M.M.; STAMATIN, O.; CARAUSU, E.M. *Rev.Chim.(Bucharest)*, **68**, no.5, 2017, p. 977
5. ALMASAN, O.C.; HEDESIU, M.; BACIUT, G.; LEUCUTA, D.C.; BACIUT, M. (2013). *Clinical Oral Investigations*, **17**(4): 1243-50. PMID: 22868824.
6. SCHIFFMAN, E.; OHRBACH, R.; TRUELOVE, E.; LOOK, J.; ANDERSON, G. et al. (2014) *J Oral Facial Pain Headache*, **28**: 6-27.
7. PETSCHAVAGE-THOMAS, J.M.; WALKER, E.A. (2014). *AJR Am. J. Roentgenol*, 203: 1047-1058.
8. DASCALU, C.G.; CARAUSU, E.M.; MANUC, D. (2008). *World Academy of Science, Engineering and Technology*; **14**: 278-82.
9. SALE, H.; BRYNDAHL, F.; ISBERG, A. (2013). *Radiology*, 267: 183-194.
10. CHECHERITA, L.E.; TRANDAFIR, V.; STAMATIN, O.; CARAUSU, E.M. *Rev.Chim.(Bucharest)*, **67**, no.7, 2016, p.1415
11. DASCALU, C.G.; ANTOHE, M.E.; GOLOVCENCU, L.; ZEGAN, G. (2017). *E-Health and Bioengineering Conference (EHB)*; 462-465. Doi: 10.1109/EHB.2017.7995461.
12. MELIS, M.; DI GIOSIA, M.; ZAWAWI, K.H. (2012). *The Journal of Craniomandibular Practice*, **30**(4): 304-312.
13. \*\*\*. [https://ubwp.buffalo.edu/rdc-tmdinternational/wp-content/uploads/sites/58/2017/01/Graded-Chronic-Pain-v2-1-month\\_2013-05-12.pdf](https://ubwp.buffalo.edu/rdc-tmdinternational/wp-content/uploads/sites/58/2017/01/Graded-Chronic-Pain-v2-1-month_2013-05-12.pdf)
14. TOTU EFTIME, E.; VOICILA, E.; PISTRITU, V.; NECHIFOR, GHE.; CRISTACHE, C.M. *Rev.Chim.(Bucharest)*, **69**,no.1,2018, p.155
15. GLENN, T. CLARK; SOMA SAHA SRIVASTAVA (2013). *Orofacial Pain*; 115-128.
16. SOLOMON, S.M.; TIMPU, D.; AGOP-FORNA, D.; MARTU STEFANACHE, M.A.; MARTU, S.; STOLERIU, S., *Mat.Plast.*, **53**, no.3, 2016,p. 546

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