Effect of targeted radiofrequency therapy in combination with post isometric relaxation in the treatment of pain syndrome in cervical region

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Background and objectives:
Pain accompanied by restricted mobility within the cervico-cranial and cervico-brachial regions is an often met condition among patients from working age population as well as patients above the age of 60-65y. Targeted Radiofrequency Therapy (TR-Therapy) is a noninvasive treatment, improving these conditions and further resulting in increased quality of life.

Aim:
The aim of this study is to evaluate the effect of TR-Therapy combined with Post Isometric Relaxation (PIR) in the treatment of painful conditions with mobility limiting factor in the cervical spine.

Materials and Methods:
30 patients experiencing pain and accompanying mobility limiting factor in the cervico-cranial and cervico-brachial regions were enrolled in this study. The Treatment group received combined sessions (TR-Therapy combined with PIR). The control group received equal number of PIR (only) treatments. The primary outcome measures were: Pain perceptions evaluation in rest, moving and upon palpation conditions (10-point VAS scale); Mobility evaluation by composite methods including Range of motion (^{O}) and distance (cm) measurements for shortened muscles evaluation. (1) Data were collected at pre- and post-treatment stage.

Results:
The results of the study show statistical difference between the levels of improvements in both treatment and control group.

Conclusion:
TR-Therapy in combination with PIR techniques is an effective method for pain treatment and mobility restoration, ameliorating patient's quality of life.

Key words:
Targeted Radiofrequency Therapy, Cervio-cranial, cervico-brachial syndrome, Pain relief, Mobility Restoration

INTRODUCTION

A significant part of working population experience pain and limited mobility within the cervico- cranial and / or cervico-brachial region. These symptoms remain valid for people above the age of 60-65 as well. (2), (3), (4) The leading cause for this in the former group is mostly connected to working conditions, such as sitting position with bad posture and fewer outdoor sport activities. (5) For the latter group and still valid for the former one too – degenerative joint disorders in the affected region could be also present.(2), (3) The described common, non-specific symptoms may further result into chronic conditions (4) if the latter are not already there.(2), (3) However, for a correct diagnosis a physical examination and a medical history review, taking into consideration the anatomical structures evolved and the pathogenesis mechanisms potentially responsible for the clinical picture, should take place.(6)

From one other point of view pain and limited mobility are resulting in direct economical costs – such as medical expenditure, and indirect economical costs – such as decreased productivity and earnings, as well as in intangible costs related with quality of life decrease.(7) The common conservative treatment with anti-inflammatory drugs and myorelaxants, as well as conventional physiotherapy methods, results in a temporal improvement of the symptoms.(8), (9) Therefore an effective treatment and prevention of similar conditions have essential importance for healthcare. Finding innovative and non-invasive solutions with greater effect than the conventional ones also appears essential nowadays.

TR-Therapy method with working frequency up to 500 kHz appears as a topic of healthcare related studies in variety of medical areas.(10), (11) The mechanism of action relies on interaction of radiofrequency current with biological structures, resulting in tissue temperature increase. The further effects depend on the level of energy transfer (12): pain relief, myorelaxation, (13), (14), (15) increase of local blood circulation and edema reduction. (16), (17)

MATERIALS AND METHODS

STUDY DESIGN:

This is a randomized, controlled study, conducted in order to study the effect of TR-Therapy combined with PIR in the treatment of pain syndrome and mobility limiting condition in cervical spine.

PARTICIPANTS:

30 participants (n=14 male and n=16 female – Figure 1.) aged between 23 and 70 with painful and mobility limiting conditions within the cervical region were enrolled in this study. They were randomly assigned into two groups – treatment and control. One patient from the treatment group left the study after the 2nd session due to personal issues.

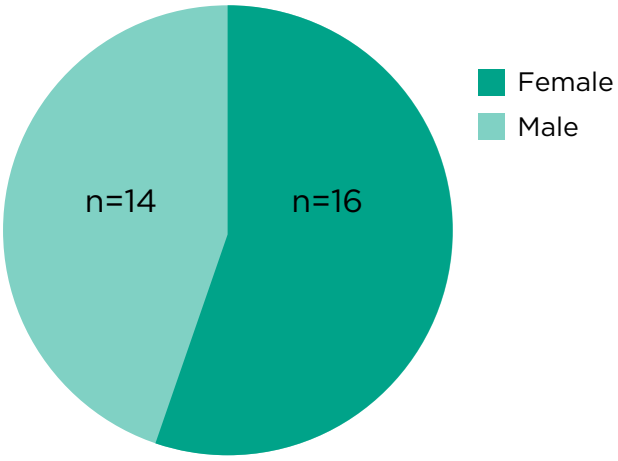

Figure 1. Gender Male / Female

The treatment group (n=14) received six (three times a week) combined therapies TR-Therapy (BTL-6000 TR-Therapy Elite device was used in this trial) followed by PIR techniques, with total duration of the whole therapy two weeks (except for the weekends). The TR-Therapy parameters were set as follow: Mode: Capacitive (CAP) + Resistive (RES); Total time: 30min (CAP section time: 10min, RES section time: 20 min); Frequency: 500 kHz (both CAP and RES); Duty factor: 100% (both CAP and RES); Subjective Intensity Valuation: CAP (II), RES (III).

All subjects were familiarized with Subjective Intensity Valuation (SIV) scale - based on the heat perception by the patient (using a scale developed by Schliephake: I – no heat perception, very low intensity; II – moderate heat perception, low intensity; III – evident heat perception, medium intensity; IV – strong, but not unpleasant, heat perception, high intensity). The patients communicated their heat perception with the therapist during the sessions.

The control group (n=15) received six (three times a week) conventional PIR therapy including three to five repetitions, with total duration of two weeks again (except for the weekends). All patients were treated by the same physiotherapist.

PRIMARY OUTCOME MEASURES:

Pain perception was evaluated by a 10-point Visual Analog Scale (VAS) (Appendix 1). Data were collected for 3 conditions: rest, moving and upon palpation. The mobility in the cervical region was evaluated by measuring ROM by goniometry, in degrees (^{O}). Shortened muscles were evaluated by measuring distance in cm. (1) All measurements in both groups were obtained at pre- and post-treatment stage (right before the first and right after the last therapy).

The ROM in the cervical region was measured while performing flexion and extension (Figure 2), lateroflexion – left, right (Figure 3) and rotation – left, right (Figure 4).

The shortened muscle evaluation was performed by a flexibility test involving flexion and extension (no parallel motion was there). Distances in cm were measured between: mandibula – sternum for m. Suboccipitalis (Figure 5), ear – acromion for m.Trapezius (Figure 6), mandibula – clavicula (pars medialis) for m. Levator scapule (Figure 7).

All treatment data of both groups were evaluated by applying descriptive statistics and t-paired test (Software SPSS version 22.0, IBM was used).

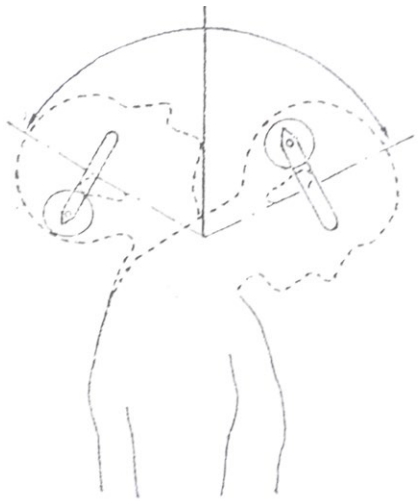

Figure 2. Flexion and Extension

Figure 5. Mandibula – Sternum

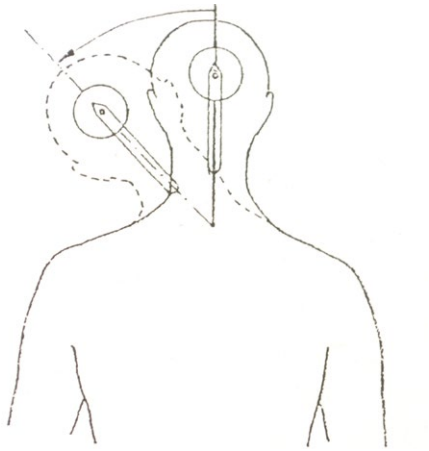

Figure 3. Lateroflexion

Figure 6. Ears – Acromion

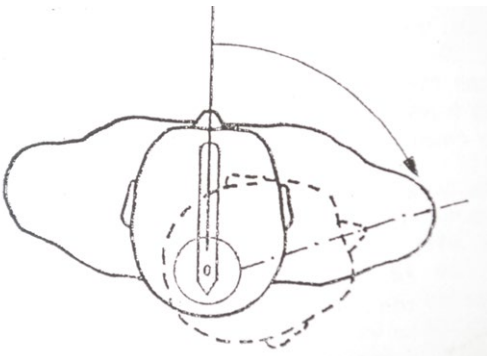

Figure 4. Rotation

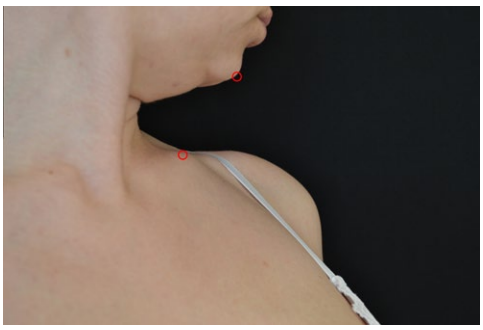

Figure 7. Mandibula - Clavicula

RESULTS

29 (n=14 male and n=15 female) participants completed the study. No side effects were observed in both groups. The outcome results (pre- and post- treatment), their statistical significance (p) and level of improvement in treatment group and control group are presented in Table 1. The pre - treatment outcome data, the level of improvement, % and the statistical comparison between both treatment and control groups are presented in Table 2.

Parameter		Treatment group (n=14)				Control group (n=15)			
		Pre	Post	Δ, %	P	Pre	Post	Δ, %	P
		Mean ± SD				Mean ± SD			
VAS	Rest	6.00±1.41	2.00±1.41	68.4	p<0.001	6.07±1.10	4.33±1.29	29.71	p<0.001
	Moving	6.71±1.27	2.43±1.74	66.03	p<0.001	6.67±1.23	5.00±1.31	25.04	p<0.05
	Palpation	7.71±1.20	3.00±1.47	61.59	p<0.001	7.67±1.23	5.73±1.16	24.85	p<0.001
ROM, °	Flexion	44.29±6.16	54.30±4.32	23.83	p<0.001	43.33±5.23	47.50±5.13	9.84	p<0.05
	Extension	51.07±7.12	59.60±7.46	17.13	p<0.05	51.33±5.50	53.70±6.40	4.55	NS
	Lateroflex Right	30.56±4.14	39.10±3.76	30.03	p<0.001	35.00±5.35	37.70±4.79	8.46	NS
	Lateroflex Left	31.43±3.63	40.00±3.40	28	p<0.001	34.67±5.50	37.40±4.42	8.74	NS
	Rotation Right	43.21±5.75	49.30±5.84	14.34	p<0.05	42.33±4.95	44.40±4.52	5.22	NS
	Rotation Left	44.00±5.69	49.64±5.71	14.24	p<0.05	42.67±5.00	44.27±4.65	4	NS
Shortened Muscle Evaluation, cm	Ear – Acromion Right	11.18±1.81	7.68±1.23	31.15	p<0.001	10.73±1.58	9.93±1.91	7.95	NS
	Ear – Acromion Left	10.79±1.53	7.36±1.08	31.65	p<0.001	10.67±1.84	9.87±2.07	7.97	NS
	Mandibula – Clavicula Right	3.29±1.54	1.71±1.38	54.76	p<0.05	3.33±1.35	2.73±1.39	22.11	NS
	Mandibula – Clavicula Left	3.50±1.70	1.71±1.54	60.14	p<0.05	3.27±1.44	2.67±1.50	23	NS
	Mandibula – Sternum	2.89±1.44	1.43±1.09	56.19	p<0.05	2.60±1.21	2.07±1.03	22.11	NS

Table 1. Outcome data

Parameter		Pre-treatment (T0)			Post-treatment(T1)		
		Treatment	Control	P	Treatment	Control	P
		mean ± SD			ΔT1-T0%		
VAS	Rest	6.00±1.41	6.07±1.10	NS	68.40	29.71	p<0.001
	Moving	6.71±1.27	6.67±1.23	NS	66.03	25.04	p<0.001
	Palpation	7.71±1.20	7.67±1.23	NS	61.59	24.85	p<0.001
ROM, °	Flexion	44.29±6.16	43.33±5.23	NS	23.83	9.84	p<0.05
	Extension	51.07±7.12	51.33±5.50	NS	17.13	4.55	p<0.001
	Lateroflex Right	30.56±4.14	35.00±5.35	NS	30.03	8.46	p<0.001
	Lateroflex Left	31.43±3.63	34.67±5.50	NS	28.00	8.74	p<0.001
	Rotation Right	43.21±5.75	42.33±4.95	NS	14.34	5.22	p<0.001
	Rotation Left	44.00±5.69	42.67±5.00	NS	14.24	4.00	p<0.001
Shortened Muscle Evaluation, cm	Ear – Acromion Right	11.18±1.81	10.73±1.58	NS	31.15	7.95	p<0.001
	Ear – Acromion Left	10.79±1.53	10.67±1.84	NS	31.65	7.97	p<0.001
	Mandibula – Clavicula Right	3.29±1.54	3.33±1.35	NS	54.76	22.11	p<0.05
	Mandibula – Clavicula Left	3.50±1.70	3.27±1.44	NS	60.14	23.00	p<0.001
	Mandibula –Sternum	2.89±1.44	2.60±1.21	NS	56.19	22.11	p<0.05

Table 2. Comparison table

DISCUSSIONS

After completing the study, a significant improvement in both groups was observed. Pain relief effect at rest described by VAS is observed for both groups – with 68.40% for treatment and 29.71% for the control (p<0.001), followed by VAS in motion (66.03% and 25.04% respectively, p<0.001) and VAS upon palpation - 61.59% improvement for the treatment and 28.85% for the control group (p<0.001). These results signify a greater pain relief effect by TR-Therapy combined with PIR in comparison to PIR only. This analgesic effect is due to greater muscle relaxation engendered by activated local blood circulation and metabolic processes.

Significant level of improvement in ROM was observed in the treatment group. Lateroflexion in left and right improved with respectively 28.00% and 30.03% (p<0.001) in comparison to the initial values, whereas in the control group the level of improvement for both sides was 8.46% (NS). There was a significant improvement in flexion (23.83%, p<0.001) and extension (17.13%, p<0.001) in the treatment group whereas in the control group the improvement was respectively 9.84% (p<0.05) and 4.55% (NS). Rotation in the cervical spine both left and right increased with approximately 14 % (p<0.001) in the treatment group, whereas the level of improvement in the control group was respectively 5.22% (NS) and 4.00% (NS). Similar results indicate myorelaxation effect of TR-Therapy combined with PIR compared to PIR only.

Shortened muscle evaluation showed significant improvement and increased mobility in cervical spine within the treatment group in comparison to the control one. Ear – acromion distance increased with 31.15% (p<0.001) in right and 31.65% (p<0.001) in left, while in the control group it is respectively 7.95% (NS) in right and 7.97% (NS) in left. Maximum improvement was measured in the treatment group in the distance mandibula – clavicula with 54.76% in right (22.11% for the control group, p<0.001) and 60.14% in left (23.00% for the control group, p<0.001). Similar results indicate myorelaxation effect of TR-Therapy combined with PIR with PIR compared to PIR only.

CONCLUSIONS

TR-Therapy in combination with conventional manual PIR techniques is an effective, safe and non-invasive method for pain decrease and mobility restoration in the cervical spine. This study suggests, that this method is beneficial and improves the quality of life among populations with painful conditions accompanied by mobility limiting factor.

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Appendix 1:

Visual Analog Scale for Pain: