

Effect of Combination Therapy [TENS & Ultrasound] and Ischemic Compression in the Treatment of Active Myofascial Trigger Points

Mukkanavar, P. B.

Lecturer, S.D.M College of Physiotherapy

Abstract

Myofascial trigger points are discrete palpable hyperirritable loci within taut bands of skeletal muscles. At present various interventions are available to treat myofascial trigger points. However, there are not many studies that have analysed the effects of combination therapy and ischemic compression in the treatment of active myofascial trigger points. The aim of this study was to find out the effect of combination therapy and ischemic compression in the treatment of active myofascial trigger points. Fifteen subjects were randomized in each combination therapy group (A) and as well as ischemic compression group (B). Both groups received treatment daily for one week. In group A, combination therapy was given for 10 minutes, whereas in group B, subjects received gradual compression of 60 seconds for 3 to 4 times. Outcome was evaluated by visual analog scale and range of motion. Study showed significant ($p < 0.05$) reduction in pain and also increased range of motion in both groups. But the pain reduction and increased range of motion was more significant in-group A than group B. Combination of TENS and ultrasound therapy proved more effective treatment modality in active trigger points and provided prompt relief of symptoms than the ischemic compression alone.

Key Words: Myofascial, Trigger points, Ischemic compression, Combination therapy, Tens, Ultrasound

Introduction

Myofascial pain syndrome is among the most commonly encountered disorders seen by physiotherapists. It is characterized by trigger points, which are defined as hyperirritable spots within taut bands of skeletal muscle fibers. The syndrome is associated with tenderness in the muscle, characteristic referred pain, spasm, and restriction of motion (*Hsueh et al, 1997*).

Trigger points are classified as being active or latent, depending on their clinical characteristics (*Han and Harrison, 1997*). An active trigger point causes pain at rest and is tender to palpation with a referred pain pattern that is similar to the patient's pain complaint (*Ling & Slocumb, 1993; Hong & Hsueh, 1996; Han and Harrison, 1997*). Occupational or recreational activities that produce repetitive stress on a specific muscle or muscle group commonly cause

chronic stress in muscle fibers, leading to trigger points (*Rachlin, 1994*). Structural imbalances may also result from chronically shortened muscle groups. These muscle groups are likely to restrict range of motion and distort the body's posture. The distortion may perpetuate overloading of other muscles, keeping trigger points active in them. In effect, the shortened muscles perpetuate myofascial pain syndromes of the other muscles (*Finn, 1994*).

Travell & Simons (1999) have claimed that myofascial trigger points from neck and shoulder muscles might play an important role in the genesis of mechanical neck pain. The exact pathology of mechanical neck pain is not clearly understood and has been purported to be related to various anatomical structures including, intervertebral joints, neural tissues, discs, muscular disorders and ligaments (*Travell & Simons, 1999; Maitland et al, 2000*).

In the literature, many treatment approaches such as ischaemic compression, stretching exercises and physical therapy modalities, including ultrasound therapies have been reported in the management of neck pain. Various studies demonstrated that ischaemic compression can be used as prophylactic or preventive measures in trigger points. It lends credibility to the common notion that ischaemic compression is superior to the other treatment approaches like the spray and stretch, heat packs, ultrasound etc.

Jaeger & Reeves (1987) reported that stretching technique reduced the intensity of referred pain and reduced the sensitivity of the trigger points treated. Many other authors recommended that stretching alone is not enough but it is helpful as an adjunct to ischaemic compression (*Travell & Simons, 1999*).

Previous studies have confirmed the utility of TENS in the treatment of myofascial trigger points (*Graff et al, 1989*), but these researchers did not study the impact of treatment in improving the mobility and degree of muscle stretching and effect on quality of life of the patients (*Travell & Simons, 1999*). Clinically some therapists find the application of ultrasound an effective means of inactivating trigger points (*Travell & Simons, 1999; Majlesi & Ynalan, 2004*). Many earlier reports suggest that the effectiveness of a treatment approach can often be enhanced by including supplemental or various combination techniques (*Bonica, 1957 and Novich, 1965*).

From the literature reviewed, it is gathered that little is known about combination therapy using ultrasound and

TENS together in the treatment of active myofascial trigger points.

The present study compared the effects of combination therapy with ischemic compression therapy in regard to acute upper back myofascial trigger point pain.

Material and Methods

The ethical committee of SDM Medical College approved the study. Thirty patients (15 women and 15 men) with pain at one side of upper back (including neck) muscles who came in the outpatient section of SDM Hospital were included in the study.

Inclusion Criteria:

1. Presence of at least one active myofascial trigger points at one side of the upper back muscles.
2. Symptoms lasting for 0-2 weeks.
3. Age between 18 to 60 years.
4. Patients with primary myofascial pain syndrome; low pain at any other area than the corresponding trigger point; pain mostly on contralateral bending of the head; negative spurling test.
5. Had not undergone application of any physiotherapy or medications to relieve pain.

Exclusion criteria:

1. Signs of cervical disc prolapse, systemic disease migraine.
2. Other neurological, orthopedic conditions.
3. Pregnancy.

The patients that fulfilled the inclusion criteria were invited to participate in the trial after obtaining their verbal as well as written consents. The total duration of the study was six days. Active trigger points were diagnosed.

Patients who met the inclusion criteria were randomly assigned to the two treatment groups (Group A and Group B). Patients in the Group A (N=15) received combination therapy consisting of ultrasound and TENS together while the patients in Group B (N=15) received ischemic compression treatment only.

Outcome measures: All the assessments were performed before the first sessions and at the termination of each session. Measurement of subjective pain using a visual analog scale (VAS) and active lateral bending of the cervical spine with the help of a goniometer were done before the first session and after each session. The anchor points of the VAS, of which all patients were informed were 0 (no pain whatsoever) and 10 (worst pain imaginable).

Treatments:

Group A subjects received a combination of ultrasound and TENS treatment, the intensity of ultrasound was 1.5 w/cm^2 (1 MHz) with a duration of 5 minutes. In this technique high-power, pain threshold, ultrasound therapy was applied in continuous modes with the probe placed directly on a trigger point and motion associated with a gradual increase of the intensity until the subject's pain tolerance was reached. It was kept at the level for 4-5 seconds and then reduced to the half intensity for another 15 seconds. This procedure was repeated three times as described by *Travell & Simons, (1999)*.

Along with ultrasound, TENS current delivered was by means of two carbon electrodes which were kept at either end of the muscle belly. The parameter for TENS were used as a negative monophasic impulse, high

voltage (<300V), low intensity (<10 μ A), short duration (10-40 μ s) with a spike of short duration (7ns). To administer the above two treatments simultaneously Combi 200 device (Gymna Unity NV), was used for the treatment.

Group B subjects received ischaemic compression therapy. In this procedure muscle was placed in position of mild stretch and then gradual pressure or compression from thumb for 10-25 seconds was applied on trigger point, followed by compression again. Stretch was given to the muscle to see any change in pain and range of motion. This procedure was repeated 3-4 times.

All the subjects in both the groups were asked to actively stretch the muscles at the end of each therapy session by maximum voluntary contraction for 30 seconds. This procedure was repeated 5 times.

Statistical analysis:

Continuous variables were represented as mean \pm standard deviation (SD). To test the differences between the groups, student 't' and Mann Whitney U tests were used (depending on the necessity of using parametric or non-parametric posts). A significant level of 0.05 was used for all comparisons. All analyses were performed with statistical software.

Results and Discussion

A total of 30 upper back pain subjects ranging in age from 18-60 years mean (29.93 yrs \pm 7.22 SD) were studied. Out of the total sample of 30 subjects, 15 were men with mean age (28.6 yrs \pm 6.24 SD) and 15 women with mean age (31.2 yrs \pm 8.11 SD). No significant differences existed between groups in terms of age and gender (table 1).

Table 1: Demographic and clinical characteristics of the two groups

AGE	GROUP A	GROUP B	p
Men (years)	28.62 ± 6.84	28.71 ± 6.01	>0.05
Women (years)	30.42 ± 8.07	31.80 ± 8.64	>0.05

VAS score

DAYS	pre	post	p	pre	post	p
1st day	7.0	6.0	<0.05	7.5	6.8	<0.05
2nd day	6.6	4.1	<0.05	6.1	5.9	>0.05
3rd day	4.3	2.6	<0.05	5.9	5.9	>0.05
4th day	2.9	2.5	>0.05	5.7	4.9	<0.05
5th day	2.4	1.8	>0.05	4.1	4.1	<0.05
6th day	2.0	1.6	>0.05	3.1	2.7	>0.05

ROM score

DAYS	pre	post	p	pre	post	p
1st day	30.53	37.40	<0.05	28.13	33.40	<0.05
2nd day	37.93	39.33	<0.05	33.47	35.80	<0.05
3rd day	38.27	40.33	>0.05	36.33	38.87	<0.05
4th day	40.33	41.60	>0.05	38.40	40.73	<0.05
5th day	41.93	42.93	>0.05	41.20	43.13	<0.05
6th day	42.93	44.73	<0.05	43.20	44.87	<0.05

Figs 1 & 2 compare the average VAS scores among the two groups before the start of treatment session and after the treatment session on different days.

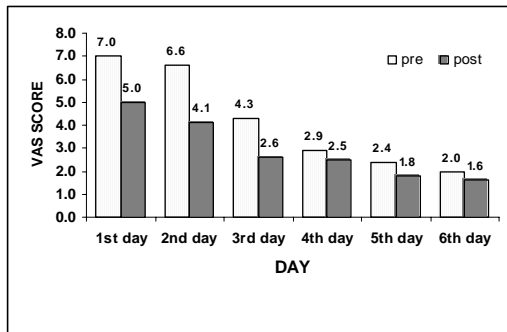


Figure 1: Comparison of pre and post VAS score in Group A subjects

Application of Wilcoxon test revealed existence of statistically significant differences between pre and post treatment session VAS score in Group A subjects' on first, second and third days of treatment (Table 1). On the other hand by using Wilcoxon test for pre

and post VAS score in Group B, statistically significant results were found on 1st day (Z=2.20, p<0.05), 4th day (Z=2.02; p<0.05) and 5th day (Z=2.20, p<0.05) of treatment.

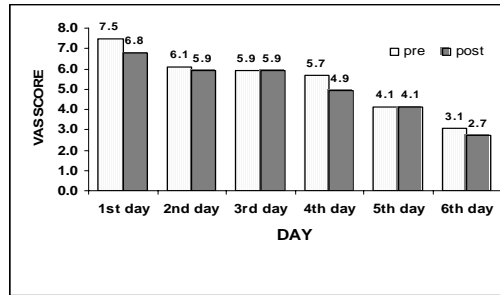


Figure 2: Comparison of pre and post VAS score in Group B subjects

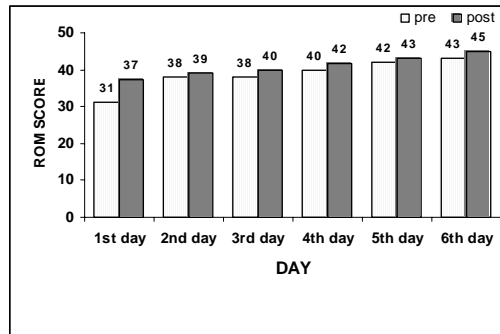


Figure 3: Comparison of pre and post ROM score in Group A subjects

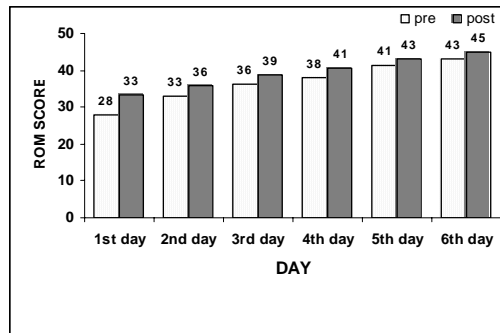


Figure 4: Comparison of pre and post ROM score in Group B subjects

Figs 3 & 4 compare the average ROM scores among the two groups before the start and after the treatment session on different days.

Application of Wilcoxon test revealed existence of statistically significant differences between pre and post treatment session ROM score in Group A subjects' on first, second and sixth days of treatment (Table 1). On the other hand by using Wilcoxon test for pre and post VAS score in Group B, statistically significant results were found on 1st day through 6th day of treatment.

Table2: Comparison between different days of VAS scores in Combination Therapy Group (A)

Treatment Gain	N	T-value	Z-value	p-level
Day 1 & Day 2	15	26.00	0.62	0.53
Day 1 & Day 3	15	35.50	0.27	0.78
Day 1 & Day 4	15	9.50	2.31	0.02*
Day 1 & Day 5	15	6.00	2.40	0.02*
Day 1 & Day 6	15	2.50	2.71	0.01*
Day 2 & Day 3	15	32.00	0.94	0.35
Day 2 & Day 4	15	7.50	2.82	0.00*
Day 2 & Day 5	15	6.00	2.59	0.01*
Day 2 & Day 6	15	2.50	3.14	0.00*
Day 3 & Day 4	15	13.00	2.04	0.04*
Day 3 & Day 5	15	18.00	1.92	0.05
Day 3 & Day 6	15	9.50	2.52	0.01*
Day 4 & Day 5	15	18.50	0.47	0.64
Day 4 & Day 6	15	20.00	0.76	0.44
Day 5 & Day 6	15	17.00	1.07	0.28

* Significant p< .05

Statistical comparisons of pre VAS score with post VAS score recorded at different days of combination therapy is summarized in table 2. It is observed that that a significant effect of treatment started appearing from day 4. In Group B, similar statistical comparison however revealed no significant differences between pre VAS score with post VAS score recorded at different days of combination therapy.

For comparison of VAS score between Group A and Group B, Mann-Whitney t-test was chosen. The 5% significant level was used for hypothesis testing.

Table 3: Comparison between Different Days of VAS Scores in Combination Therapy Group (CTG) and Ishaemic Compression Group (ICG)

Treatment	Time	Rank Sum CTG	Rank Sum ICG	U value	Z value	p-level
1 st day	Pre	209.00	256.00	89.0	-0.97	0.33
	Post	158.50	306.50	38.5	-3.07	0.00
	Diff.	283.50	181.50	61.5	-2.12	0.03
2 nd day	Pre	241.50	223.50	103.5	-0.37	0.79
	Post	180.50	284.50	60.5	-2.16	0.03
	Diff.	318.00	147.00	27.0	-3.55	0.00
3 rd day	Pre	178.50	286.50	58.5	-2.24	0.02
	Post	142.50	322.50	22.5	-3.73	0.00
	Diff.	293.00	172.00	52.0	-2.51	0.01
4 th day	Pre	164.50	300.50	44.5	-2.82	0.05
	Post	179.00	286.00	59.0	-2.22	0.03
	Diff.	222.50	242.50	102.5	-0.41	0.68
5 th day	Pre	162.00	303.00	42.0	-2.92	0.00
	Post	176.50	288.50	56.5	-2.32	0.02
	Diff.	225.50	239.50	105.5	-0.29	0.77
6 th day	Pre	178.50	286.50	58.5	-2.24	0.02
	Post	173.50	291.50	53.5	-2.45	0.01
	Diff.	226.00	239.00	106.0	-0.27	0.79

Significant p< .05

Table 3 shows descriptive measures and rank sums for both groups. A significant difference between all days VAS scores for the two groups was found. The table also shows difference of mean, which is compared for both the groups for all days.

For both the groups paired t-test was used to analyze the difference between pre and post ROM scores on different days of treatment. In Group A, using paired t-test for pre and post ROM, significant difference was found on first day (t - 4.88, p < 0.05), 2nd day (t - 2.67, p < 0.05) and 6th day (t - 3.54 , p < 0.05) (table 1). Whereas in Group B, using paired t-test for pre and post ROM a very significant difference was found in all days of treatment. In both the groups maximum ROM changes were noticed on 1st day (table 1).

Table 4: Comparison between different days of ROM scores in Combination Therapy Group (A)

Day	Mean	SD	Mean Diff	% effect	SD Diff	paired t-value	Signi.
1	-6.87	5.45	-5.47	79.61	5.77	-3.67	p<.05
2	-1.40	2.03					
1	-6.87	5.45	-4.80	69.90	6.16	-3.02	p<.05
3	-2.07	3.77					
1	-6.87	5.45	-5.60	81.55	7.31	-2.97	p<.05
4	-1.27	2.94					
1	-6.87	5.45	-5.87	85.44	6.41	-3.54	p<.05
5	-1.00	2.62					
1	-6.87	5.45	-5.07	73.79	5.98	-3.28	p<.05
6	-1.80	1.97					
2	-1.40	2.028	0.67	-47.62	3.81	0.68	p>.05
3	-2.07	3.77					
2	-1.40	2.03	-0.13	9.52	3.25	-0.16	p>.05
4	-1.27	2.94					
2	-1.40	2.03	-0.40	28.57	3.66	-0.42	p>.05
5	-1.00	2.62					
2	-1.40	2.03	0.40	-28.57	1.92	0.81	p>.05
6	-1.80	1.97					
3	-2.07	3.77	-0.80	38.71	4.31	-0.72	p>.05
4	-1.27	2.94					
3	-2.07	3.77	-1.07	51.61	4.17	-0.99	p>.05
5	-1.00	2.62					
3	-2.07	3.77	-0.27	12.90	3.71	-0.28	p>.05
6	-1.80	1.97					
4	-1.27	2.94	-0.27	21.05	3.41	-0.30	p>.05
5	-1.00	2.62					
4	-1.27	2.94	0.53	-42.11	3.44	0.60	p>.05
6	-1.80	1.97					
5	-1.00	2.62	0.80	-80.00	3.00	1.03	p>.05
6	-1.80	1.97					

Table 5: Comparison between Different Days of ROM Scores in Combination Therapy Group (CTG) and Ishaemic Compression Group (ICG)

		CTG		ICG		t-value	p-value
		Mean	SD	Mean	SD		
1st day	Pre	30.53	9.64	28.13	9.36	0.69	0.49
	Post	37.40	8.05	33.40	9.49	1.24	0.22
	Diff.	-6.87	5.45	-5.27	5.55	-0.79	0.43
2nd day	Pre	37.93	7.99	33.47	9.57	1.39	0.18
	Post	39.33	7.25	35.80	8.71	1.21	0.24
	Diff.	-1.40	2.03	-2.33	2.19	1.21	0.24
3rd day	Pre	38.27	8.19	36.33	7.67	0.67	0.51
	Post	40.33	5.86	38.87	5.76	0.69	0.49
	Diff.	-2.07	3.77	-2.53	3.36	0.36	0.72
4th day	Pre	40.33	5.86	38.40	6.08	0.86	0.38
	Post	41.60	4.89	40.73	5.51	0.46	0.65
	Diff.	-1.27	2.94	-2.33	3.54	0.89	0.38
5th day	Pre	41.93	4.73	41.20	5.62	0.39	0.70
	Post	42.93	3.59	43.13	4.73	-0.13	0.89
	Diff.	-1.00	2.62	-1.93	2.99	0.91	0.37
6th day	Pre	42.93	3.59	43.20	3.49	-0.21	0.84
	Post	44.73	2.79	44.87	3.64	-0.11	0.91
	Diff.	-1.80	1.97	-1.67	2.02	-0.18	0.86

Significant p<.05

Table 4 represents comparison between pre ROM scores of before combination treatment with post combination treatment ROM scores for all days.

In Group B, (Ischaemic Compression), no statistically significant differences were found in the ROM scores recorded before treatment and post treatment on all the days.

For comparison of ROM scores between Group A and Group B, independent t-test was chosen. A two-tailed test was conducted with alpha set at 0.05 (table 5). No statistical significant difference between all day's ROM scores for the two groups was found. Table 5 show descriptive measures alongwith the difference of mean which is compared for both groups for all days.

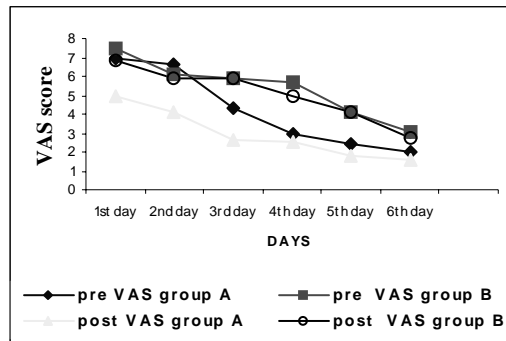


Figure 6: Comparison of pre and post VAS score for Group A and Group B on different days of treatment

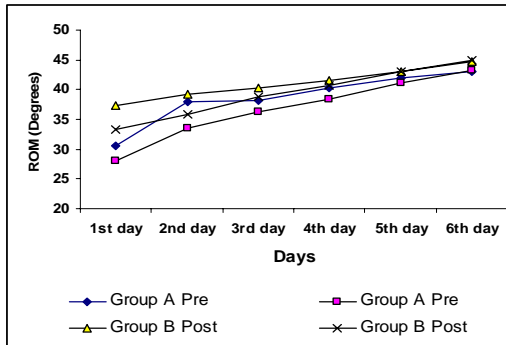


Figure 7: Comparison of pre and post ROM scores for Group A and Group B on different days of treatment

Discussion

In our study all the subjects with neck pain had trigger points in the upper fibers of the trapezium muscles in right and/or left sides. It was also observed that associated with pain there was muscle spasm with limitation of joint range of motion in auricle vertebrae. This study showed that both the treatment groups (A & B) had a reduction in pain intensity of myofascial trigger points as well as an increase in the ranges of motion in the neck followed by treatment.

According to *Horat (1969)* and *Bovin et al (1994)*, neck pain is common with an estimated point prevalence of nearly 13% & a lifetime prevalence of 50%. Different conservative management of mechanical neck pain has been tested in the literature but with conflicting results and at present no treatment strategy is generally accepted (*Aker et al., 1996*). The application of two therapeutic modalities simultaneously and at the same site is reported in the literature and described as combination therapy. The most widely used conservations are Ultrasound & TENS. The justification for the use of combination therapy is principally suggested because the beneficial effects of both modalities may be achieved at the same time. The use of combination therapy is to enhance the effect of one therapy upon the other making the combination more effective than either of the therapy alone.

TENS and Ultrasound are being used in physical therapy to inactivate trigger points. Many papers have been published in the issues of the effect of ultrasound & TENS in musculoskeletal disorders (*Travell & Simons, 1999*). But very few studies studied both effect of

Ultrasound & TENS on pain & range of motion (*Bonica, 1957 & Novich, 1965*).

Ischaemic compression technique is non invasive & seems to be free of adverse effects if applied after accurate diagnosis with knowledge of regional anatomy. This technique can be used as a prophylactic or preventive measure. The virtue of this technique is that it is painless & imposes no additional strain on any attachment trigger points & there by avoids aggravating them (*Travell & Simons, 1999*).

There are not many published studies that have analysed the effects of combination therapy & ischaemic compression in the treatment of active myofascial trigger points.

This study revealed decrease in the pain immediately following combination therapy than ischaemic compression treatment. Study also revealed appearance of the effect of treatment from day 1 & 2 in the case of the combination therapy group.

Travel & Simmons (1999) noticed etiology of trigger points is because of dysfunctional motor end plates. Application of Ultrasound undoubtedly cause tissue heating, which could result into inhibition of releasing acetylcholine & reduce end plate dysfunction.

TENS on the other hand helps in the pain modulation by inhibition of pain pathways at spinal cord level. The additional benefits of this modality are that, it helps in improving the quality of life, which in turn help the patient to achieve increased mobility & degree of muscle stretching (*Travell & Simons, 1999*). Based on these effects Group A

showed immediate & early reduction in pain & range of motion.

Group 'B' also showed decrease in the pain. This can be explained in terms of Ischaemic pressure that probably might have lead to temporarily occlusion of blood supply & causing reactive hyperaemia, which in turn helped in flushing out the muscle of inflammatory exudates & pain metabolites, breaking down scar tissue, & reducing muscle tone. There wasn't any significant difference found in terms of range of motion in both the groups. In the present study cervical range of motion increased more in group 'A' as compared to Group 'B'. This effect can be due to more effective decrease in spasm along with pain induced by combination therapy. Along with these treatment techniques stretching also lead to the increase in the range motion in both groups. According to *Travel & Simmons (1999)*, stretching helps in releasing the contracted sarcomeres of the contraction knots in the trigger point.

Several study limitations should be noted as the present study report only a comparison of treatment techniques in case of active trigger point pain. The study contained no long-term follow up & no measures of functional improvement.

Conclusions

Combination therapy resolves acute active trigger point's pain & increases range of motion rapidly than Ischaemic compression treatment technique.

Acknowledgement

Author would like to thank each patient who participated in the study.

References:

Aker, P. D., Gross, A. R., Goldsmith, C.H. and Peolasa, P. 1996. Conservative management

- of mechanical neck pain: A Systematic Review, *Br. Med. J.*, **313**: 1291-96.
- Bonica, J.J.: 1957. Management of myofascial pain syndromes in general practice. *JAMA*, **164**: 32-738.
- Bovim, G., Schrader, H. and Sand, T. 1994. Neck pain in the general population. *Spine*, 1307-1309.
- Farina, S., Casarotto, M., Benelle M, Tinazzi M, Fiaschi, A., Goldoni, M., Smania, N.. 2004. A randomized control study on the effect of two different treatments (FREMS AND TENS) in myofascial pain syndrome. *Eur. Medico Phys.*, **40**: 293-301.
- Finn, R. 1994. Shortened muscle groups-a common perpetuating factor. *The Journal of Myofascial Therapy*, Vol. **1**: 47-49.
- Graff-Radford, S.B., Reeves, J.L., Baker, R.L., Chiu, D. 1989. Effects of transcutaneous electrical nerve stimulation on myofascial pain & trigger point sensitivity. *Pain*, **37(1)**:1-5.
- Han, S.C., Harrison, P. 1997. Myofascial pain syndrome and trigger point management. *Reg. Anesth.* **22**: 89-101.
- Hong, C.Z., Hsueh, T.C. 1996. Difference in pain relief after trigger point injections in myofascial pain patients with and without fibromyalgia. *Arch. Phys. Med. Rehabil.*, **77**: 1161-6.
- Horal, J. 1969. The clinical appearance of low back disorders in the city of Gothenburg, Sweden, *Acta. Ortho. Scand. Suppl.*, **118**: 42-45.
- Hsueh, T.C., Cheng, P.T., Kuan, T.S., Hong, C.Z. 1997. The immediate effectiveness of electrical nerve stimulation and electrical muscle stimulation on myofascial trigger points. *Am. J. Phys. Med. Rehabil.*, **76**: 471-6.
- Jaeger, B., Reeves, J.I. 1987. Quantifications of changes in myofascial trigger point sensitivity with the pressure algometer following passive stretch. *Pain*, **27**: 203-210.
- Ling, F.W., Slocumb, J.C. 1993. Use of trigger point injections in chronic pelvic pain. *Obst. Gynecol. Clin. North Am.*, **20**: 809-15.
- Maitland, G., Hengeveld, E., Banks, K., English, K. 2000. *Maitlands Vertebral manipulation*, 6th ed.: Butterworths Heineman, London.
- Majlesi, J., Ynalán, H. 2004. High-power pain threshold ultrasound technique in the treatment of active myofascial triggers points: A randomized, double-blind, case-control study. *Arch. Phys. Med. Rehabil.*, **85**: 833-36.
- Novich, M.M. 1965. Physical therapy in treatment of athletic injuries. *Tex. State J. Med.*, **61**: 672-74.

Rachlin, E.S. 1994. Trigger points. In: *Myofascial pain and fibromyalgia: trigger point management*. ed.: Rachlin, E.S., St. Louis: Mosby, 145-57.

Travell, J.G., Simons, D.G. 1999. *Myofascial pain and dysfunction: The Trigger Point Manual*. Vol 1. 2nd ed., Baltimore: Williams & Wilkins, 147.