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ORIGINAL ARTICLE

To Analyze the Efficacy of Transdermal Magnesium oil with Exercises and only Exercises in Non-Specific Neck Pain: A Randomized Controlled Trial

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ABSTRACT
Non-specific neck pain is a common condition that can affect individuals at some point in their lives. It is characterized by discomfort and pain in the neck area, without a specific identifiable cause or underlying condition. Magnesium is a vital mineral that plays a crucial role in various physiological functions within the body, including pain management. Magnesium also exhibits important properties that can influence pain perception and provide relief in certain pain conditions. Hence the aim of this study to assess the effect of Magnesium with the exercises versus only exercises in subjects with non-specific neck pain. 30 subjects clinically diagnosed with non-specific neck pain were randomly divided into 2 groups, control and experimental group (n=15). The control group was given conventional therapy i.e. exercises like chin tuck and static exercises and experimental group was given conventional therapy (exercises) along with transdermal application of magnesium oil. All outcome measures like VAS, NDI and Magnesium RBC levels were assessed pre and post intervention and statistically analysed. There was marked improvement seen in both groups, but there was significant improvement in VAS, Magnesium RBC levels seen in experimental group while there was improvement seen functional outcomes namely NDI. This suggests that magnesium with exercises is more effective than only exercises in treating non-specific neck pain patients.
Key words: *Non-specific neck pain, Magnesium, VAS, NDI, Chin tuck.*

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INTRODUCTION

Non-specific neck pain is a common condition that can affect individuals at some point in their lives. It is characterized by discomfort and pain in the neck area, without a specific identifiable cause or underlying condition. This type of neck pain can vary in intensity and duration, ranging from mild and temporary to chronic and debilitating, impacting mobility and overall well-being [1].

Most individuals with neck pain do not experience complete resolution of symptoms, as 50% to 85% of those who experience neck pain report its recurrence within 1 to 5 years [2].

Managing non-specific neck pain involves a comprehensive approach that focuses on alleviating symptoms, improving function, and preventing further episodes. Treatment options may include rest, physical therapy, strengthening exercises, posture correction, stress management techniques, and lifestyle modifications [3].

Exercises are essential in the treatment of neck discomfort since they have many positive effects. One of their main duties is to relieve discomfort and pain by gently stretching and loosening up tight and contracted muscles. Exercises that increase strength focus on the neck's supporting muscles, improving stability and lowering the possibility of strain [4].

Magnesium is a vital mineral that plays a crucial role in various physiological functions within the body, including pain management. It is involved in more than 300 enzymatic reactions, contributing to muscle and nerve function, energy production, protein synthesis, and maintaining a healthy immune system. Magnesium also exhibits important properties that can influence pain perception and provide relief in certain pain conditions [5].

Magnesium influences pain management is its ability to regulate the function of N-methyl-D-aspartate (NMDA) receptors. NMDA receptors are involved in the transmission and modulation of pain signals within the central nervous system. Magnesium acts as a natural antagonist to these receptors, blocking their activation and reducing the sensitivity to pain stimuli. This antagonistic effect can help alleviate pain and provide a modulating effect on pain perception. Studies have also suggested a correlation between magnesium deficiency and increased sensitivity to pain. Individuals with inadequate magnesium levels may experience heightened pain perception and reduced pain tolerance [6-8]. Therefore, ensuring sufficient magnesium intake through diet or supplementation may be beneficial in managing pain.

To evaluate the efficacy of magnesium transdermal in non-specific neck pain as determined by magnesium RBC levels.

MATERIAL AND METHODS

In the present study, the subjects with non-specific neck pain will be allocated into two groups – Group A (Control) & Group B (Experimental). Group A will receive conventional physiotherapy management i.e. exercises, while Group B will receive the transdermal application of Mg oil traditional physiotherapy treatment include spraying the afflicted region. So, the present study is randomised controlled trial.

Consent and ethical considerations

Institutional Ethical Committee permission for the research was sought and granted for the intended study. PACIFIC MEDICAL COLLEGE & HOSPITAL, UDAIPUR. A Written Consent was obtained from each subject who will be willing to participate in the study before the commencement of the study.

Study Population

In the present study population consisted of 30 patients of NSNP who met the inclusion criteria and having a clinical diagnosis of non-specific neck discomfort from an orthopaedician who present to "Pacific Medical College and Hospital, Pacific College of Physiotherapy".

Sample Size

30 patients with non-specific neck pain, residing in Udaipur.

15 - Treatment with topical application of Magnesium along with exercises

15 - Treatment with exercises

Sample method: Random sampling method.

Inclusion Criteria:

Age – 18- 40, both male and females.

Non-specific Neck pain more than 2 weeks.

Exclusion Criteria:

Patients with existing neurological condition, congenital diseases, auto-immune diseases, tumors and malignancies, cervical dystonia, cervical myelopathy, cervical spondylitis, spondylitis, cervical spondylolisthesis.

Patients with history of any spine surgery

Patients with fractures or any deformities

Patients having any skin conditions

Patients with history of whiplash injuries, dislocations of spine

Age less than 18 and more than 40

Data analysis:

Data was collected using MS Excel and was than analyzed using Statistical Package Of Social Sciences (SPSS) version 21. Variables were than subjected to find number and percentage, mean, standard deviation etc. Mann-Whitney U, Wilcoxon matched pair, ANOVA test and Chi square tests were applied as per requirement and level of significance was obtained. A p value of less than 0.05 was considered significant.

RESULTS

Demographic characteristics of study population.

Table 1: Comparison of Group A and B Patients by Age

	A		B		Total	
Age group (yrs.)	**No.**	**%**	**No.**	**%**	**No.**	**%**
<21	1	6.67%	1	6.67%	2	6.67%
21-30	8	53.33%	10	66.67%	18	60.00%
31-40	6	40.00%	4	26.67%	10	33.33%
Total	15	100.00%	15	100.00%	30	100.00%

The demographic characteristics of patients evaluated in this study have been Presented in Table 1.

Table 2: Patients in Groups A and B, Broken Down by Gender

	A		B		Total	
Gender	**No.**	**%**	**No.**	**%**	**No.**	**%**
Male	5	33.33%	9	60.00%	14	46.67%
Female	10	66.67%	6	40.00%	16	53.33%
Total	15	100.00%	15	100.00%	30	100.00%

COMPARISON OF VAS SCORE AT Pre, Post1 AND Post2 FOR GROUP A AND B

Table 3: Mean and SD of VAS at Pre, Post1 and Post2 for Group A and B

VAS	Group A		Group B	
	$\bar{X}$	SD	$\bar{X}$	SD
Pre	6.20	1.66	7.73	1.22
Post 1	4.80	1.70	3.87	1.06
Post 2	3.00	1.46	0.53	0.74
MD Post1-Pre	1.40	0.74	3.87	1.25
MD Post2-Pre	3.20	1.21	7.20	1.42
MD Post1-Post2	1.80	1.08	3.33	0.90

Group A and Group B's VAS scores and the X Difference at three time points are compared in Table 3 (0^{th} day, Post 1 & Post 2). At 0^{th} day, Post 1 & Post 2 the $\bar{x}$ & $\boldsymbol{\sigma}$ values of Group A were 6.20±1.66, 4.80±1.70 & 3.00±1.46 respectively. While the $\bar{x}$ & $\boldsymbol{\sigma}$ values of Group B at 0^{th} day, Post 1 & Post 2 were 7.73±1.422, 3.87±1.06 & 0.53±0.74 respectively. The MD values at Post1-Pre, Post2-Pre & Post1-Post2 Group A were 1.40±0.74, 3.20±1.21 & 1.80±1.08 respectively. While Group B MD values at Post1-Pre, Post2-Pre & Post1-Post2 Group A were 3.54±1.25, 7.20±1.42 & 3.33±0.90 respectively.

Table 4: Comparison of Mean Value for VAS at Pre, Post1 and Post2 and MD (0-3^{rd} month), MD (0-6^{th} month) and MD (3^{rd} -6th) month amongst Group A and B

VAS	Group A Vs Group B	
	t value	P value
Pre	2.88	0.008
Post 1	1.80	0.083
Post 2	5.84	<0.001
MD Post1-Pre	6.59	<0.001
MD Post2-Pre	8.30	<0.001
MD Post1-Post2	4.22	<0.001

The statistically significant improvement in pain on VAS was seen in both the groups when compared at three intervals- 0 vs 3^{rd} months, 0 vs 6^{th} months & 3^{rd} vs 6^{th} month. The t-value at p<0.001 in Group A at 0 vs 3^{rd} month, 0 vs 6^{th} month & 3^{rd} vs 6^{th} month was 7.36, 10.27 & 6.44 respectively while in Group B was 12.02, 19.58 & 14.35 respectively. The pain was significant improved in Group A as comparatively to Group B when we compared the $\bar{x}$ value and $\bar{x}$ difference of Group A VS Group B. The t-value (0.008)) at 0^{th} day shows insignificant change while on 3^{rd} month & 6^{th} month (<0.001) t-value was 1.80 & 5.84 respectively when compared Group A vs Group B which signifies statistically significant improvement in pain.

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COMPARISON OF MG RBC LEVEL AT Pre, Post1 AND Post2 FOR GROUP A AND B

Table 5: Comparison of the Means for Mg RBC Level at Pre, Post1, Post2 and within Group A and B

Mg RBC Level	Group A		Group B	
	$\bar{X}$	SD	$\bar{X}$	SD
Pre	1.32	0.49	1.31	0.60
Post 1	1.22	0.53	2.36	1.90
Post 2	1.15	0.52	2.23	0.41
MD Post1-Pre	0.10	0.15	1.05	2.00
MD Post2-Pre	0.17	0.26	0.92	0.46
MD Post1-Post2	0.07	0.14	0.13	1.95

Group A and Group B's Mg RBC Levels and the X Difference at Three Intervals are displayed in Table 5. (0^{th} day, Post 1 & Post 2). At 0^{th} day, Post 1 & Post 2 the $\bar{x}$ & **σ** values of Group A were 1.32±0.49 1.22±0.53 & 1.15±0.52 respectively. While the $\bar{x}$ & **σ** values of Group B at 0^{th} day, Post 1 & Post 2 were 1.31±0.60, 2.36±1.90 & 2.23±0.41 respectively. The MD values at Post1-Pre, Post2-Pre & Post1-Post2 Group A were -0.10±0.15, 0.17±0.26 & 0.07±0.14 respectively. While Group B MD values at Post1-Pre, Post2-Pre & Post1-Post2 Group A were 1.05±2.00, 0.92±0.46 & 0.13±1.95 respectively.

Table 6: Values Comparing Means for Magnesium RBC Level at Pre, Post1 and Post2 and MD (0-3rd month), MD (0-6th month) and MD (3rd-6th) month between Group A and B

Serum Mg Level	Group A Vs Group B	
	t value	P value
Pre	0.05	0.960
Post 1	2.24	0.033
Post 2	6.32	<0.001
MD Post1-Pre	2.22	0.035
MD Post2-Pre	7.99	<0.001
MD Post1-Post2	0.12	0.906

The statistically significant improvement in Magnesium RBC level was seen in Group B & non-significant change in Group Baseline (day 0), Post-Intervention (Day 1), and Post-Intervention (Day 2) comparisons of the groups. Group A and Group B were compared at three time points for their Serum Mg Levels and X Difference (0^{th} day, Post 1 & Post 2). At 0^{th} day, Post 1 & Post 2 the $\bar{x}$ & **σ** values of Group A were 1.32±0.49 1.22±0.53 & 1.15±0.52 respectively. While the $\bar{x}$ & **σ** values of Group B at 0^{th} day, Post 1 & Post 2 were 1.31±0.60, 2.36±1.90 & 2.23±0.41 respectively. The MD values at Post1-Pre, Post2-Pre & Post1-Post2 Group A were -0.10±0.15, 0.17±0.26 & 0.07±0.14 respectively. While Group B MD values at Post1-Pre, Post2-Pre & Post1-Post2 Group A were 1.05±2.00, 0.92±0.46 & 0.13±1.95 respectively.

COMPARISON OF NDI AT Pre, Post1 AND Post2 FOR GROUP A AND B

Table 7: Values Comparing Means for NDI at Pre, Post1, Post2 and within Group A and Group B

NDI	Group A		Group B	
	$\bar{X}$	SD	$\bar{X}$	SD
Pre	51.58	5.30	55.29	9.90
Post 1	32.47	6.92	28.46	5.28
Post 2	21.76	2.15	14.71	5.25
MD Post1-Pre	19.11	6.73	26.83	8.47
MD Post2-Pre	29.82	5.70	40.59	13.32
MD Post1-Post2	10.71	6.25	13.75	7.39

Table 7 displays the comparison of neck disability on NDI scale and $\bar{X}$ Alteration among Group A and B at three different intervals (0^{th} day, Post 1 & Post 2). At 0^{th} day, Post 1 & Post 2 the $\bar{x}$ & **σ** values of Group A were 51.58±5.30, 32.47±6.92 & 21.76±2.15 respectively. While the $\bar{x}$ & **σ** values of Group B at 0^{th} day, Post 1 & Post 2 were 22.29±9.90, 28.46±5.28 & 14.71±5.25 respectively. The MD values at Post1-Pre, Post2-Pre & Post1-Post2 Group A were 19.11±6.73,29.82±5.70 & 10.71±6.75 respectively. While Group B MD values at Post1-Pre, Post2-Pre & Post1-Post2 Group A were 26.83±8.47, 40.59±13.32 & 13.75±7.39 respectively.

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Table 8: Values Comparing Means for NDI at Pre, Post1 and Post2 and MD (Pre Vs Post 1), MD (0-6th month) and MD (3rd-6th) month between Group A and Group B

NDI	Group A Vs Group B	
	t value	P value
Pre	1.28	0.211
Post 1	1.78	0.085
Post 2	4.81	<0.001
MD Post1-Pre	2.76	0.010
MD Post2-Pre	2.88	0.008
MD Post1-Post2	1.22	0.234

When comparing the NDI at baseline, after 3 months, and after 6 months, both groups showed statistically significant improvement. In Group A, the t-values at p0.001 were 8.37, 12.24, and 9.11 when comparing the first and third months, and 6.40, 10.15, and 6.56 when comparing the first and sixth months. When we analysed the x value and x difference of Group A VS Group B, we found that Group A had much better neck impairment. When comparing Group A with Group B, the t-values at Day 0 (0.001), Month 3 (0.001), and Month 6 (0.001), were 1.28, 1.78, and 4.81, respectively, indicating a statistically significant increase in neck impairment.

DISCUSSION

Rehabilitation for neck pain is dramatically change in nowadays there are major components for the neck ache rehabilitation or neck pain management in a traditional way but there is a major disorientation in treating neck pain because physical symptoms is only one a part of other associated and one major part is blood-chemistry is also playing major role to treating neck pain in current era but it is neglected due to lack of awareness, magnesium deficiency is profoundly is seen in every age group teenager to old age population because magnesium is 4th most abundant mineral in the body which is playing vital role and muscle in muscular contraction and relaxation along with helping to change PH of muscle [9, 10].

A very efficient and effective strategy for raising intracellular magnesium levels and achieving a favorable calcium-magnesium balance. Since every cell in the body bathes and feeds on magnesium, transdermal application is the best technique to restore depleted cellular magnesium levels and Magnesium sulphate ($MgS0_4$) & Magnesium citrate ($C_6H_6mgO_7$) is often used in as a muscle relaxant for use in orthopaedic medicine through relaxing NMDA receptor and vasodilator properties that can have an analgesic effect. These properties can likely be attributed to its ability to block presynaptic acetylcholine discharge from neuromuscular and sympathetic junctions. Moreover, $C_6H_6mgO_7$ solution can also have an ant nociceptive effect in central and visceral pain tests, indicating its potential for use as an adjuvant pain therapy with limited adverse reactions. Previous studies have administered $C_6H_6mgO_7$ orally or intravenously to reduce pain intensity, particularly in patients with myogenous pain [3, 8, 6].

In the present study, total 30 subjects were participated in the study which had divided into two groups, 15 in each group. The control group (Group A) was given transdermal Mg oil in addition to conventional physiotherapy i.e. exercises whereas Group B was given only conventional physiotherapy treatment i.e. exercise. The total 14 were males and 16 were females in the present study which was categorised into age group <21, 21-30 & 31-40 in which 2, 18 & 10 patients were included respectively.

The efficacy of treatment Protocol was measured on Pain by using VAS, neck disability by NDI, Serum Mg level on taking blood sample at baseline (0^{th} day), post-intervention -1 & Post-intervention-2 in both groups.

CONCLUSION

We found from the current research that patients who got transdermal application of Mg oil had substantial improvements in pain, neck impairment, and magnesium RBC levels compared to those who received simply exercise treatment.

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