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INFLUENCE OF MASTICATORY PERFORMANCE ON COGNITION, ATTENTION AND EXECUTIVE FUNCTION IN YOUNG INDIVIDUALS

Reena K* , Jyoti N** , Siddhartha Sen***

Introduction: Masticatory performance is a coordinated function of the masticatory system. It may be effective in preventing senile dementia by maintaining a good blood flow within the brain. It has been suggested that chewing may accelerate or recover the process of working memory, besides inducing improvement in the arousal level by the chewing motion.

Objectives: To find out the influence of masticatory performance on cognition, attention and executive function in young individuals.

Method and Procedure: A sample of 100 subjects (50 females and 50 males) between ages of 19 to 25 yrs. was selected on the basis of inclusion and exclusion criteria. Procedure conducted was carried out in three steps, First - Gummy jelly was formulated in the pharmaceutical laboratory, Second - Masticatory performance was evaluated through glucose extraction using gummy jelly for each subject, Third - Cognition, attention and memory was evaluated using MMSE, Trail Making part A and B for each subject. Then Data was collected and recorded.

Data analysis: it was done using Karl Pearson correlation test between masticatory performance and cognition in young female and male subjects.

Results: Results of the study showed that there is less correlation with cognition, attention and executive function. Conclusion: conclude that masticatory performance has less influence on cognition, attention and executive function exists among young female and male subjects.

Keywords: Masticatory performance, Cognition, Attention, Executive function

INTRODUCTION

Thinking, remembering, reasoning and making sense of the world around us are fundamental to carrying out everyday living activities and these mental abilities by which a human gains knowledge and becomes aware of events in its environment and uses that knowledge for comprehension and problem-solving, are termed as cognition. The term cognition derived from Latin word cognoscere, which means "to know" or "to recognize". Executive functions include the capacity to plan, manipulate information, initiate and terminate activities, recognize errors, problem solve, and think abstractly. Commonly, executive functions are categorized as higher order cognitive functions

Problems with capacities such as thinking or remembering are some of the most puzzling and disabling difficulties and can have a devastating effect on an individual's life and the lives of his or her family members. Cognitive rehabilitation, are designed to reduce cognitive dysfunction and/or assist individuals in compensating for its impact on daily living.

Cognitive skills can be improved through carefully designed cognitive exercise programs individually tailored to needs. Cognitive exercises, including computer-assisted strategies, have been used to improve specific neuropsychological processes, predominantly attention, memory, and executive skills. It's long been recognized that staying mentally engaged by working, volunteering, reading, doing crossword puzzles and brain teasers, etc. can keep you sharper, in addition to several recent studies also indicated that masticatory performance or chewing could...
improve an individual’s cognitive function can even prevent the progress of dementia or Alzheimer’s disease (Yue Zhenzhu et al., 2006)

Masticatory performance is a coordinated function of the masticatory system. The masticatory system is a functional unit composed of the teeth; their supporting structures, the jaws; the temporomandibular joints; the muscles involved directly or indirectly in masticatory performance (including the muscles of the lips and tongue); and the vascular and nervous systems (Una Soboleva, 2005)

During masticatory exercise the rise of body temperature in facial and brain areas was noted clinically and experimentally, and this may contribute to the activation of cerebral blood flow and metabolism in brain function. The interaction between chewing and blood circulation in the brain area was examined during masticatory performance. The rise of cerebral blood flow at masticatory performance was confirmed to be associated with the increase of blood flow in the internal carotid artery. (Minoru Nakata, 1998)

Furthermore, recent studies have shown that chewing is associated with activation of various brain regions including the prefrontal cortex. However, little is know about the relation between cognitive performances affected by chewing and the neuronal activities in the brain during a working memory task using fMRI. Chewing increased the BOLD (blood oxygenation level dependent) signals in the middle frontal gyrus (broadmann’s area 9 and 46) in the dorsolateral prefrontal cortex. Further more, there were more activations in the right premotor cortex, percueneus, thalamus, hippocampus and inferior parietal lobe during then-back tasks after the chewing trial (Hirano Yoshiyuki et al, 2008)

Positron Emission Tomography (PET) has been developed recently and applied to brain research in connection with masticatory performance. Cerebral blood flow image during gum chewing showed an increased blood flow in the bilateral lower frontal and parietal lobes. These increases of cerebral blood flow with chewing and masticatory performance were found in the oral region of the primary sensorimotor cortices and supplementary motor areas, the insulae, striatum and cerebellum. This area, the lower part of the Rolandic area (or primary sensorimotor area), is believed to receive sensory input from the lips, tongue, oral mucosa, gingivae, teeth, periodontal ligaments, mandible and temporo-mandibular joint and to control masticatory movement, lingual and facial muscles, and thus may be called the ‘masticatory center’ (Minoru Nakata, 1998).

It is suggested that masticatory performance may be effective in preventing senile dementia by maintaining a good blood flow within the brain. The above studies suggest that chewing may accelerate or recover the process of working memory, besides inducing improvement in the arousal level by the chewing motion.

Cognition is important for processing of information, which helps an individual to adapt to his environment. A number of neurobiological, psychological and social factors may account for cognitive impairments. Several studies have indicated a relationship between reduced masticatory function in elderly subject and cognitive impairments. This study tries to find out the correlation of masticatory performance, cognition and executive function among young females and males.

**METHODOLOGY**

100 subjects of 19-25 years of both genders were selected in the study on the basis of inclusion and exclusion criteria. Before starting with the procedure, the subjects who were selected were explained the entire procedure in details and their consent was taken prior to the study. Inclusion criteria for the study were subjects with full complement of teeth excluding third molar without major dental restoration and any kind of orthodontic treatment (braces).Any oral diseases, Any systemic or masticatory abnormalities, Any past dental or oral surgeries (maxillofacial surgery), Any acute conditions like mouth ulcers, gum disease, individuals having problems in hearing, vision were excluded from the study. The masticatory performance were measured using glucose extraction method, cognition by using mini mental status examination (MMSE) and attention & executive function were measured using trial making A & B test.
**PROCEDURE**

Measurement of masticatory performance:

The gummy jelly was formulated in Pharmaceutical laboratory of SBSPGI, Gummy jelly was prepared according to the ingredients listed below:

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Percentage %</th>
<th>Weight in mgm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maltose</td>
<td>40%</td>
<td>800mgm</td>
</tr>
<tr>
<td>d-Sorbitol</td>
<td>10%</td>
<td>200mgm</td>
</tr>
<tr>
<td>Glucose</td>
<td>5%</td>
<td>100mgm</td>
</tr>
<tr>
<td>Gelatin</td>
<td>8%</td>
<td>160mgm</td>
</tr>
<tr>
<td>Others</td>
<td>37%</td>
<td>740mgm</td>
</tr>
</tbody>
</table>

Others include – Glycerin – 480mgm; Distilled Water – 255mgm; Sodium saccharine – 5mgm the Weight of jelly was 2 gm and Size was 10 X10mm

Before starting the procedure subject was instructed to chew the jelly on their habitual side for 20 secs. Subjects were asked to rinse their mouth with 10 ml of distilled water and to spit into a cup with a filter and filtrate was collected. This filtrate was served as the test material. The glucose concentration of the filtrate was measured chromatically and quantitatively by the Glucose Oxydase method. Glucose extraction was measured (Yoshinori. K et al., 2006) by GOD-POD kit and UV spectrometer after chewing 2 gm of gummy jelly.

Preparation of GOD-POD Reagent (50 X 50 ml) – 1 tab was dissolved in 50 ml of distilled water. Measuring procedure was as flows: Initially 2ml of reagent was transferred to each of 3 test tubes using 2 ml of pipette and then 0.02 ml of filtrate (test material) and standard was transferred to first and second test tube respectively by micropipette and third one was left as it is i.e. Blank. Then it was incubated for 30 mins at the room temperature. Then blank, standard and samples were transferred one by one in to UV spectrometer. Absorbance of standard and samples given by UV spectrometer at 505nm was recorded and glucose concentration was calculated following this formula,

\[
\text{Glucose concentration (mg/dl)} = \frac{\text{absorbance of sample}}{\text{absorbance of standard}} \times 100
\]

**Measurement of Cognition:**

Cognition for all the subjects was assessed using MMSE scale (Bergdahl M. et al, 2007 & Dufouil C.,2000). The scale consists of six components with a total score of 30. The components of scale with their scores are orientation (10), registration (3), attention and calculation (5), recall (3), language (9).

**Measurement of Attention & Executive functions:**

Executive function for all subjects was assessed through Trail Making Test (Bhatia Tet al., 2009 & Gaudiano E. A.,1995). In this test, there are two parts, Part A and Part B. In part A the participants is required to connect numbers sequentially i.e. 1→2→3 and so on and in Part –B the participants are required to join the numbers and alphabets alternatively in sequential manner i.e. 1→A→2→B→3→C and so on the time taken to complete the task both in Part A and Part B was recorded.

**RESULTS**

The data was analyzed using statistical tests that were performed using SPSS version10.00 software package. Initially, mean and standard deviations of glucose extraction, MMSE and Trail making test A and B was calculated. Later, Karl Pearson coefficient was used to find out the correlation and unpaired t- test was to find out the difference of mastication, cognition and executive function among males and females.

The significant value was fixed at p<0.05 with confidence interval of 95%.

The mean and standard deviation for the glucose extraction, MMSE score, Trail making test A and B of females and males.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Females</th>
<th>Males</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose extraction</td>
<td>381.72 ±116.38</td>
<td>391.85 ±111.77</td>
</tr>
<tr>
<td>MMSE</td>
<td>27.74 ±1.46</td>
<td>28.08 ±1.38</td>
</tr>
<tr>
<td>Trail Making Test A</td>
<td>31.40 ± 8.74</td>
<td>32.11 ± 10.93</td>
</tr>
<tr>
<td>Trail Making Test B</td>
<td>31.40 ± 8.74</td>
<td>60.77 ± 19.63</td>
</tr>
</tbody>
</table>

**TABLE 1**
### TABLE-2

<table>
<thead>
<tr>
<th>Variables</th>
<th>Females</th>
<th>Males</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r value</td>
<td>sig</td>
</tr>
<tr>
<td>Glucose extraction and MMSE</td>
<td>0.011</td>
<td>0.583</td>
</tr>
<tr>
<td>Glucose extraction and Trail Making Test A</td>
<td>0.047</td>
<td>0.744</td>
</tr>
<tr>
<td>Glucose extraction and Trail making Test B</td>
<td>-0.068</td>
<td>0.639</td>
</tr>
</tbody>
</table>

**DISCUSSION**

The result of the study revealed that there is less correlation between masticatory performance and cognition among female and male subjects. The correlation values were found to be $r = 0.011$ in females and $r = 0.1301$ in males. The result failed to demonstrate the existence of relationship between masticatory performance and cognition, this inconsistency might be due to methodological shortcomings while evaluating glucose extraction and ingredients of the gummy jelly other glucose like maltose and sorbitol might be interfering with the evaluation of glucose extraction.

Tucha O et al (2004), examined memory and a variety of intentional functions of healthy adult participants under four different conditions and results showed that the chewing of gum did not improve participants' memory functions. Furthermore, chewing may differentially affect specific aspects of attention and in conclusion, claims that the chewing a gum improves cognition should be viewed with caution.

Yue Zhenzhu et al 2006, analyzed quantitatively the activities in certain brain regions like precentral gyrus, which is the most activated region during masticatory performance, result of their study revealed that when in comparison with resting, masticatory performance produced a strong blood oxygenation level (BOLD) signal change in precentral gyrus and the average change was 46.3%,
indicating the increased demand of blood flow and oxygen delivery in the brain during masticatory performance.\textsuperscript{5}

The study was conducted in young adults that may have shown the insignificant relation as Onozuka M et al (2008), in there study concluded that only the aged subjects showed significant increases in various association areas to which input activities in the primary sensorimotor cortex, supplementary area, or insula had positive path coefficients. The findings suggest the involvement of chewing in memory processes.\textsuperscript{31} Another study by Wilkinson et al in 2002 indicated that chewing a piece of gum results in improvement of working memory and of both immediate an delayed recall of words but not of attention. Also single Trail Making Test B was used to examine executive function.

For the comparison of masticatory performance, cognition and attention among males and females was analyzed through unpaired t-test. Comparison showed no significant (p>0.05) differences for masticatory performance among female and male subjects. For Glucose extraction Anne Mishellany D in 2008, reported that in young healthy subjects the particle size distribution of ready to swallow food boulses, displays narrow inter individual variability and result of their revealed no sex effect for either ground nut or carrots.\textsuperscript{10}

The result showed no significant difference for attention and executive function in males and females. The value found to be t = 1.192 for MMSE t= 0.357 in Trail A and t = 0.999 in Trail B which is in accordance with Heidi Weiman, emphasize that there are more similarities than differences between the cognitive abilities of males and females.\textsuperscript{11}

In 2005, Hyde compiled meta-analyses on sex differences not only in cognition but also communication style, social or personality variables, motor behaviors and moral reasoning. In half the studies, sex differences were small; in another third they were almost non-existent. Thus, 78 percent of gender differences are small or close to zero.\textsuperscript{12}

The limitation of the study was that the Glucose extraction method through gummy jelly was simply based on instructions, the eating habits of subjects were not taken into consideration, Right and left dominance of chewing habit were not checked and subjects with any malocclusion were not taken into consideration.

CONCLUSION

The study conclude to state that masticatory performance has less influence on cognition, attention and executive function exists among young female and male subjects.

REFERENCES


EFFICACY OF MCCONNELL’S TAPING ON PAIN, DISABILITY AND EMG ACTIVITY OF VMO IN SUBJECTS WITH PATELLOFEMORAL PAIN SYNDROME

Mahesh Sharma* Anish Raj**

 INTRODUCTION

Patellofemoral pain is one of most common knee complaints encountered in sports medicine and general population1. It is however thought to occur at higher incidence in athletes and females .Patellofemoral syndrome may be characterised by following: Dull aching pain which is usually vague in location, often described as around or under the patella; symptoms are aggravated with walking, running, ascending or descending stairs, or prolonged sitting (positive movie sign); pain with squatting or kneeling; also of the leg buckling, or presence of crepitus.2

The causes of PFPS are not completely understood, but are generally secondary to patellofemoral malalignment. Possible causes of patellofemoral malalignment are numerous and include faulty lower extremity alignment, Extensor mechanism dysfunction, and flexibility and strength deficient of lower extremities. Lower extremity alignment and kinematic faults include excessive pronation6, Genu Recurvatum, Genu valgum and Genu varum, Increased Q angle11, femoral Anteversion and External Tibial rotation8 and faulty patellar orientation during static and dynamic assessment12,13. Extensor mechanism dysfunction can result from quadriceps atrophy, particularly the VMO14 or faulty recruitment of the Quadriceps Musculature during flexibility during Activation15, another factor that may cause patellofemoral malalignment is faulty flexibility and muscle strength of lower extremity. The most common muscle which lack flexibility includes illiopsoas, illiotibial band, rectus femoris, Hamstring and Gastro Solieous group1. Strength of Gluteus, Gluteus Maximus and Trunk Extensors are also Factors that should be assessed. Initially, patients are managed conservatively. This often involves a combination of following measures- quadriceps strengthening

Purpose: To find out efficacy of taping on pain, disability and EMG of VMO in subjects with PFPS and find out Post treatment effect of taping on EMG of VMO

Method: Minimum of 30 subjects both males and females were conveniently allocated in two groups A and B. In Group A choice of Treatment were VMO strengthening, Taping, TENS. In Group B choice of treatment were TENS, VMO strengthening. All subjects in both groups received treatment for three weeks five times per week for total of 15 treatment sessions. Data collection for VAS, WOMAC, EMG analysis for VMO was done on 1st Day pre treatment, 5th, 10th, 15th and 20th day without tape revaluation was done.

Results: The results showed a significant reduction in pain, disability and improvement in the VMO strength in both groups. Group A (Tape Group) shows more significant improvement in pain, disability and strength than group B (P < 0.05). Group A showed earlier improvement in all variables under this study.

Conclusion: McConnell’s taping of knee along with VMO strengthening in patellofemoral syndrome significantly improves pain; disability and strength of VMO in patients with patellofemoral joint pain syndrome and benefits’ remain even after stopping the treatment. It is long term efficient treatment for patellofemoral joint pain syndrome.

Keywords: McConnell’s Taping, Transcutanious electrical nerve stimulation, EMG of VMO, VMO Strengthening, Patellofemoral joint syndrome.

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** M.P.Th. Osteomyology, Assistant Professor, DAV Institute of Physiotherapy and Rehabilitation Mahatma Hans Raj Marg, GT Road, Jalandhar
exercises (this include quadriceps setting, straight leg raises, isotonic exercises in last 30 degrees of extension), ice or heat, ultrasound, patellar mobilisation, non steroidal anti inflammatory drugs, faradic stimulation of vastus medialis muscle, isokinetic exercises for quadriceps and hamstrings, hamstring stretches, cast immobilisation, shoe orthotics and or walking aids. If conservative management fails surgery is next option but surgical management is fraught with difficulty because of complex nature of extensor mechanism and problem resulting from compromised knee function. Fortunately more radicals surgeries patellectomy a relative common procedure and having detrimental effect on knee joint mechanism is rarely performed today. Recent evidence has cast doubt on efficacy of more conservative operative procedures such as medial alignment of the tibial tubercle to decrease the Q angle. Huberti and hayes working on cadaveric knees found that both increased and decreased Q angles were associated with peak patellofemoral pressures and un predictable patterns of cartilage unloading at different locations on the patella. They concluded that decrease as well as increase Q angle could be potential aetiological factor for chondromalacia patellae. This may help to explain why some patients who are symptom free following surgery have a return of symptom later Doucette and Gobe found that a comprehensive program of exercise to address deficits found on Physical Examination of Patients with Lateral compression syndrome did indeed result in decreased pain and improved Trackling. McConnell has suggested the use of Patellar Taping in addition to exercise program. The suggested rationale is that Patellar Taping will improve patellar tackling, thereby decreasing the potential for pain and swelling which may cause vmo inhibition. Taping may also improve active recruitment of VMO by restoring more normal length tension ratio in VMO.

MATERIAL AND METHODOLOGY

Patients of either sex between age of 18 to 40 were taken.

Inclusion Criteria:
1. Patient presenting with unilateral anterior knee pain

Data collection procedure

Variables:
- Independent variables:
  - TENS
  - VMO Strengthening
  - McConnell's taping

- Dependent variable:
  - Vas Scale
  - WOMAC scale
  - EMG of VMO

Instrumentation:
- McConnell’s tape.
- Transcutaneous electrical nerve stimulation
- Electromyography machine.

Methods of collection of data

Protocol

30 subjects were selected based on Inclusion and Exclusion Criteria. Subject were described procedural details to be followed in this study and there after Consent Form (appendix 1) was obtained. After all the examination subjects were then placed in respective experimental Group A and Group B conveniently. Both groups consisted of 15 Subjects each. In Group A choice of treatment were VMO Strengthening, TENS and Taping. In Group B choice of treatment were TENS and VMO strengthening. During the treatment phase all the Subject of Groups A and B received treatment for three weeks 5 times per week for total of 15 Treatment Session. Data
collection for VAS, WOMAC and EMG Analysis was done on 1st day Pre Treatment, 5th, 10th, 15th, 20th day with Tape. And on 20th day without Tape Re-evaluation was done.

**EMG procedure:**
EMG data from the belly of Vastus Medialis Oblique was collected. The Subject’s skin was prepared by shaving off the hair and outer layer epidermal cells and cleaning with alcohol Swab. A surface EMG electrode was placed over midpoint of the belly of Vastus Medialis Oblique. The Vastus Medialis Oblique electrode was placed approximately 4cm superior to and 3cm medial to supra medial Patellar Border. Oriented 55° to long Axis of patella. The Quadriceps muscles were contracted Isometrically prior to electrode placement, the midpoint of muscle belly was identified. The electrode was linked to an amplifier box that was connected via a fibre optic cable to a computer. Patient was positioned supine or long sitting. Rolled towel or bolster was placed under the knee to support it in flexion and patient was instructed to extend his knee and hold it for 15 seconds. Five readings were taken at one time and after that mean of these five reading was calculated. EMG analysis was done on first day Pre treatment, 5th, 10th, 15th and on 20th day without Tape re-evaluation was done.9

**VMO Strengthening**:
1. **Static Quads**- Position of patient was supine and rolled towel was placed under his knee and patient was instructed to press towel with knee then Hold for 10 seconds.
2. **Short Arc terminals**- Position of patient was supine or long sitting. A rolled towel was placed under the Knee to support it in flexion and patient was instructed to extend his knee.
3. **Step ups**- Forward and backward step up and step downs. The patient was instructed to step up and down a single step.

All the exercises were performed starting with 3 sets, 10 repetition in each set for one week. After each set 2 minutes rest was given and progression was done to five sets after one week.

**McConnell’s taping:**
The patellar taping was applied by using the medial gliding technique established by McConnell’s13. The 15cm cover roll tape was applied directly on to the Skin. The 12 cm lukotape rigid Tape was applied, starting from the lateral Femoral condyle, anchoring over the patella and ending at the Posterior Knee with enough medial force applied to shift the Patella medially. When Taping was complete an obvious “pouch” of skin (crease) was visible at the medial knee to standardize the amount of medialization, the tape was pulled until a skin crease of greater than 2cm wide was measured at the medial side of knee. A 2cm Crease width indicates a medial pull applied to the patella.2

**DATA COLLECTION TOOLS:**
Data was collected on the data collection form, VAS scale, WOMAC Scale, electromyography were collected on
1st day - Pre-Treatment
5th day
10th day
15th day
20th day - post - Treatment

**STATISTICAL ANALYSIS**
Data analysis was performed using SPSS software version 13. Inter group comparison was done. Unpaired t test were used to determine significance of difference between experiment Group A and Control Group B. Post Hock were done to determine significance of difference between subjects of same Group (within group). Level of significance selected for the study was p < 0.05.

**RESULTS**

<table>
<thead>
<tr>
<th>Table 1 Comparison of VAS between both Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>TREATMENT DAYS</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>DAY1</td>
</tr>
<tr>
<td>DAY5</td>
</tr>
<tr>
<td>DAY10</td>
</tr>
<tr>
<td>DAY15</td>
</tr>
<tr>
<td>DAY20</td>
</tr>
</tbody>
</table>
Table 2 Comparison of WOMAC between both Groups

<table>
<thead>
<tr>
<th>TREATMENT DAYS</th>
<th>MEAN ± SD (GROUPA)</th>
<th>MEAN ± SD (GROUPB)</th>
<th>STAT t</th>
<th>P - value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAY 1</td>
<td>40.27 ± 7.41</td>
<td>35.93 ± 4.00</td>
<td>2.11</td>
<td>0.785</td>
</tr>
<tr>
<td>DAY 5</td>
<td>24.93 ± 5.93</td>
<td>30.53 ± 3.14</td>
<td>3.23</td>
<td>0.003</td>
</tr>
<tr>
<td>DAY 10</td>
<td>8.67 ± 4.59</td>
<td>17.87 ± 3.48</td>
<td>6.18</td>
<td>0</td>
</tr>
<tr>
<td>DAY 15</td>
<td>0.00 ± 0.00</td>
<td>7.20 ± 2.96</td>
<td>9.43</td>
<td>0</td>
</tr>
<tr>
<td>DAY 20</td>
<td>0.00 ± 0.00</td>
<td>0.07 ± 0.26</td>
<td>1.00</td>
<td>0.326</td>
</tr>
</tbody>
</table>

Table 3 Comparison of EMG between both Groups

<table>
<thead>
<tr>
<th>TREATMENT DAYS</th>
<th>MEAN ± SD (GROUPA)</th>
<th>MEAN ± SD (GROUPB)</th>
<th>STAT t</th>
<th>P - value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAY 1</td>
<td>673.69 ± 224.36</td>
<td>568.43 ± 138.67</td>
<td>1.55</td>
<td>0.13</td>
</tr>
<tr>
<td>DAY 5</td>
<td>869.83 ± 304.57</td>
<td>653.97 ± 162.98</td>
<td>2.42</td>
<td>0.02</td>
</tr>
<tr>
<td>DAY 10</td>
<td>1004.84 ± 254.82</td>
<td>748.46 ± 191.65</td>
<td>3.11</td>
<td>0.00</td>
</tr>
<tr>
<td>DAY 15</td>
<td>1121.79 ± 206.34</td>
<td>831.75 ± 201.28</td>
<td>3.90</td>
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<tr>
<td>DAY 20</td>
<td>1212.79 ± 319.98</td>
<td>864.74 ± 210.19</td>
<td>3.52</td>
<td>0.00</td>
</tr>
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</table>

Table 4 Comparison within group for VAS

<table>
<thead>
<tr>
<th>DAYS</th>
<th>Group A (P - value)</th>
<th>Group B (P – value)</th>
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</thead>
<tbody>
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<td>Day15/Day20</td>
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</table>

Table 5 Comparison of WOMAC within the Group

<table>
<thead>
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<th>DAYS</th>
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<th>Group B (P – value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day1/Day5</td>
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<td>S</td>
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<tr>
<td>Day1/Day10</td>
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<tr>
<td>Day15/Day20</td>
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Table 6 Comparison of EMG within the Group

<table>
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</table>

Graph 1 Comparison of VAS between both groups
DISCUSSION

The study aimed to find out the Efficacy of taping on pain, Disability and EMG of VMO in subjects with patellofemoral pain syndrome and to find out post treatment effect of Tapping on EMG of VMO. The study was carried out in 30 patients of patellofemoral pain syndrome. Subjects were divided into two groups conveniently. Group A and Group B. Both Groups were given VMO strengthening and High TENS for 15 days. Group A was given McConnell’s taping in addition to above treatment. The last day of treatment was taken as day 20 (follow up) to evaluate efficacy of the treatment. The results showed a significant reduction in pain, disability and improvement in the VMO strength in both groups. Group A shows more significant improvement in pain, disability and strength than group B (P < 0.05). Group A showed earlier improvement in all variables under this study.
Reduction in pain and disability could be because of TENS, Tapping and VMO strengthening. According to Melzak and Wall theory of Pain gait. Application of High TENS cause impulses to be carried along large diameter afferent nerves and this can produce presynaptic inhibition of transmission of nociceptive A delta and C fibers at Substentia Gelatinosa of the pain gate.5

Cushnaghan J et al, in his cohort study of medial patellar tape application for four days showed a reduction in pain in patients with patellofemoral joint pain syndrome.10 VMO strengthening contributes to relief of pain and disability in subjects with patellofemoral joint pain syndrome Docuette SA et al in his study the effect of exercise on patellar tracking in lateral patellar compression syndrome concluded that 84% of the subjects were pain free after exercise demonstrating less patellar Maltracking.3

Mechanism of pain relief and disability by tapping is by relieving pressure on damaged lateral facets of patellofemoral joint and improving tracking of patella and Quadriceps mechanism.10 Hinman RS et al, in a similar study concluded that therapeutic knee taping is an efficacious treatment for management of pain and disability in patients with knee osteoarthritis.7

Tapping enhance VMO activity similar study exhibits this fact. Wendy L. Gilleard et al, showed that tapping the patellofemoral joint changes the onset timing of VMO and VL activity. The earlier activation of the VMO may promote VMO activity during retraining, improving patellar tracking.16 The results of this study showed significant improvement in all variables of study undertaken. Group A showed earlier improvement in pain, disability and strength of VMO. This is because of early medialisation of patella or improved lateral maltracking of patella and earlier activation of VMO. Thus this study establishes the fact that McConnell’s taping improves the symptoms of patellofemoral syndrome and benefits can be maintained even after stopping the treatment. So we can say that McConnell’s taping is long term efficient treatment for patellofemoral joint pain syndrome.

CONCLUSION
This study concludes that McConnell’s taping of knee along with VMO strengthening in patellofemoral syndrome significantly improves pain; disability and strength of VMO in patients with patellofemoral joint pain syndrome and benefits’ remain even after stopping the treatment. It is long term efficient treatment for patellofemoral joint pain syndrome. Whereas both group showed significant improvement in pain, disability and VMO strengthening both treatment are effective in treating patellofemoral joint pain syndrome. Therefore study supports the experimental hypothesis.

REFERENCES
2. Buchbinder MR, Napora Nj, Biggs EW. The Relationship of Abnormal Pronation to Chondromalacia of Patella in Distance Runners. J Am Podiatric Assoc 1979; 69; 159-162


EMG ANALYSIS OF ACTIVATION PATTERN OF THE SUPRASPINATUS MUSCLE DURING THREE DIFFERENT POSITIONS

Bhupinderjit Kaur * Dr. Pravin Kumar **

Purpose: The purpose of this study was to measure the EMG activity of supraspinatus muscle during Full-can, Empty-can and Prone full-can test positions and to compare that which test position is having maximum supraspinatus muscle EMG activity.

Methods: A total of 100 subjects of both genders were taken in the study. Subject performed MVIC for supraspinatus muscle with the shoulder was elevated to 90° in scapular plane, elbow extended and the shoulder was in neutral rotation. After MVIC the subject performed isometric contraction of supraspinatus in three test positions i.e. Full-can, Empty-can, prone full-can position one by one and EMG activity of supraspinatus was recorded.

Results: Repeated measure ANOVA showed significant (p<0.05) difference in the EMG activity of supraspinatus muscle among the three different test positions with mean 3017.9±990 (Full-can), 2858.3±917 (Empty-can) and 3091.6±994 (Prone full-can). Post hoc paired t-test was done between the positions which showed Prone Full-can position had significant (p<0.05) increase in EMG activity when compared to Empty-can position whereas when Prone Full-can position compared to Full-can position showed Non-Significant (p>0.05) difference in EMG activity although the mean value of EMG activity was more in Full-can position but does not reach to the level of significance. When we compared Full-can position to Empty-can position, Full-can position showed significant (p<0.05) increase in EMG activity. Post Hoc Turkey test among the three test positions suggest that there was maximum EMG activity was in Prone full-can followed by Full-can and then Empty-can position.

Conclusion: It can be concluded from the results of the study that there was significant (p<0.05) difference in EMG activity of supraspinatus muscle among three different test positions. Prone full-can test position showed highly significant increase in EMG activity among the Full-can and Empty-can test positions.

Keywords: EMG activity, Supraspinatus, Full-can, Empty-can, Prone full-can position

INTRODUCTION
Rotator cuff injuries are a common cause of shoulder pain in people of all age groups. They represent a spectrum of disease, ranging from acute reversible tendinitis to massive tears involving the supraspinatus, infraspinatus and subscapularis. Younger individuals with rotator cuff injuries relate a history of repetitive overhead activities involving the rotator cuff or less commonly a history of trauma preceding clinical onset of symptoms.1

The frequency of full thickness rotator cuff tears ranges from 5-40% with an increasing incidence of cuff pathology in advanced age. Cadaveric studies by Bigliani et al found that 39% of individuals older than 60 years had full thickness rotator cuff tears with an even higher incidence of partial tears of the shoulder caused by a weakness in supporting ligament. Pathological lesions of the rotator cuff, particularly supraspinatus muscle often develops because of overuse or traumatic injury as it is the most injured rotator cuff muscle. Any pathological condition of rotator cuff may affect the ability to provide this compressive force resulting in superior humeral head migration and potential impingement against the acromion.2 Therefore strengthening of rotator cuff muscles, especially the supraspinatus is one of the integral parts of a rehabilitation program. Thus the rotator cuff muscles play a vital role in normal arthrokinematics and asymptomatic shoulder function. Several investigators have attempted to

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quantify the amount of supraspinatus EMG activity during various exercises along with specific positions in asymptomatic individuals.

The purpose of our study is to know the effective position i.e. Full can, Empty can and Prone full can in which supraspinatus is more activated and hence that test position is used for strengthening the supraspinatus in rehabilitation programs as it is the muscle that injured first in rotator cuff injury and is an important part of shoulder rehabilitation.

**AIMS AND OBJECTIVES**
Aim of this study was to measure the EMG activity of supraspinatus muscle during Full-can, Empty-can and Prone full-can test positions and to compare that which test position is having maximum supraspinatus muscle EMG activity.

**LITERATURE REVIEW**
A review of literature has shown that effective exercise for supraspinatus muscle has been a topic of interest for researchers in the past. Various studies have been proposed by researchers to explain EMG activity of supraspinatus muscle in different positions.

Wendy s burke et al suggested that rotator cuff weakness has been implicated as a cause of subacromial impingement and numerous exercises have been advocated to strengthen rotator cuff, mainly supraspinatus. The clinical rationale and the two exercises advocated for strengthening the supraspinatus, the empty can and the full can, were evaluated. 

Ruckstuhl H, et al conducted a study in which the abduction moment arms of four shoulder muscles were calculated in clinically important positions to evaluate the best test situation for the supraspinatus based on its mechanical advantage. The supraspinatus has a greater mechanical advantage and the other tested muscles in the neutral arm position. As per Jobe the supraspinatus abduction moment arm is reduced with increased internal humeral rotation.

Worrel TW et al, conducted a study that the supraspinatus is the most frequently injured musculotendinous structure of the shoulder, the most efficient position for testing and rehabilitation of this structure should be identified.

So the purpose of my study was to find out the the best position for strengthening the supraspinatus muscle as well as helping in finding better rehabilitation of the muscle during three different positions.

**MATERIAL AND METHODS**
The study design was experimental in nature. Study was conducted at DAV Institute of physiotherapy and Rehabilitation OPD, Jalandhar. Total duration of study was one and a half year. Total 100 subjects were taken in the study. All subjects were selected according to the criteria as follows:

**INCLUSION CRITERIA**
1) Age-18-30yr
2) Gender-Both males and female
3) Subject should be co-operative and healthy.

**EXCLUSION CRITERIA**
1) History of shoulder injury.
2) Fracture of upper limb.
3) Myelopathy.
4) Rotator cuff injury.
5) Any neurological condition affecting shoulder complex.
6) Psychological problem i.e. Anxiety, Depression.

**PROCEDURE**
A written consent was obtained from all the subjects. All the subjects who met the inclusion and exclusion criteria in the study were taken and the required assessment of every subject was done. First of all, subject performed MVIC for the supraspinatus muscle as resisted isometric contraction and the position was that the shoulder was elevated to 90° in the scapular plane, the elbow was extended and the shoulder was in neutral rotation.

After MVIC the subject performed isometric contraction of supraspinatus in three test positions i.e. Full-can, Empty-can and prone full-can position one by one and EMG activity of supraspinatus was recorded. Electrode placement was determined by
palpation of the middle portion of the spine of scapula, then moving superiorly 2 finger widths in the supraspinatus fossa. The electrodes were placed 2 cm apart, directly above the spine of scapula, over the suprascapular fossa. A ground electrode was placed on the olecranon process of the arm being tested. The skin should be cleaned with spirit and after placing surface electrodes the isometric contractions was given in each test positions with rest time between 1 and 2 minutes and EMG activity was noted in supraspinatus.

TEST POSITIONS
FULL CAN POSITION (Fig. 1)- Subject elevates the upper extremity at approximately 300 of horizontal abduction in the plane of scapula and full GH external rotation.

EMPTY CAN POSITION (Fig. 2)- Subject elevates the upper extremity at approximately 300 of horizontal abduction in the plane of scapula and full GH internal rotation.

PRONE FULL CAN POSITION (Fig. 3)- Subject performs prone horizontal abduction at approximately 1000 of GH abduction and full external rotation.

analyze the EMG activity between the test positions. Level of significance selected for study was p<0.05.

The study consisted of total of 100 subjects with mean age of 22.49 (±2.19), out of which 68 were females and 32 were males.

RESULTS
Statistics were performed using the SPSS 13.0 software. EMG differences among the three test positions was analyzed for the statistical significance by using repeated measure ANOVA test and post hoc turkey test. Paired t-test was done to

Comparison among three test positions:
Repeated measure ANOVA was done among the three test positions Full-can, Empty-can and Prone full-can positions for EMG activity. The mean score of EMG activity in Full-can position was 3017.9 (±990), Empty-can position 2858.3 (±917) and Prone full-can position was 3091.6 (±994). The F value for EMG activity was 8.51 (p<0.05). The results of repeated measure ANOVA suggest that there was significant difference (p<0.05) of EMG activity among three different test positions of supraspinatus muscle. (Table no.1) (Fig.no.4).
**Table 1: Comparison of EMG Activity of Three Test Positions**

<table>
<thead>
<tr>
<th>Test positions</th>
<th>EMG activity Mean ± SD</th>
<th>F value</th>
<th>Level of significance (p value)</th>
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<tbody>
<tr>
<td>Full Can</td>
<td>3017.9 ± 990</td>
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<tr>
<td>Empty Can</td>
<td>2858.3 ± 917</td>
<td>8.51</td>
<td>.0002</td>
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<tr>
<td>Prone Full Can</td>
<td>3091.6 ± 994</td>
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</tbody>
</table>

S- Significant (p<0.05)

**Fig. 4: Comparison of EMG activity of Three Test Positions**

Paired t-test was done to analyze EMG activity of supraspinatus muscle between the Full-can and Empty-can test positions. The t-value for EMG activity was 3.157 (p<0.05). The results of paired t-test suggest that there was significant (p<0.05) increase in EMG activity during Full-can position mean score 3017.9 (+990) when compared to Empty can position was 2858.3 (+917). (Table no.2) (Fig.no.5).

**Table 2: Comparison between the Full can and Empty can Test Positions**

<table>
<thead>
<tr>
<th>Test positions</th>
<th>EMG activity Mean ± SD</th>
<th>t-value</th>
<th>Level of significance (p value)</th>
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<tbody>
<tr>
<td>Full Can</td>
<td>3017.9 ± 990</td>
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<td></td>
</tr>
<tr>
<td>Empty Can</td>
<td>2858.3 ± 917</td>
<td>3.157</td>
<td>S</td>
</tr>
</tbody>
</table>

S- Significant (p<0.05)

**Fig. 5: Comparison between Full can and Empty can Test Positions**

Paired t-test was done to analyze EMG activity of supraspinatus muscle between the Full-can and Empty-can test positions. The t-value for EMG activity was 3.737 (p<0.05). The results of paired t-test suggest that there was significant (p<0.05) increase in EMG activity during the Empty can position mean score 2858.3 (+917) when compared to Prone Full-can test position mean score 3091.6 (+994). (Table no.3) (Fig.no.6)

**Table 3: Comparison between Full can and Prone Full can Test Positions**

<table>
<thead>
<tr>
<th>Test positions</th>
<th>Mean ± SD</th>
<th>t-value</th>
<th>Level of Significance (p value)</th>
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</thead>
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<tr>
<td>Prone Full Can</td>
<td>3091.6 ± 994</td>
<td>1.232</td>
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</tbody>
</table>

NS- Non Significant (p>0.05)

**Fig. 6: Comparison between Full can and Prone Full can Test Positions**

Paired t-test was done to analyze EMG activity of supraspinatus muscle between the Empty-can and Prone-full can test positions. The t-value for EMG activity was 3.737 (p<0.05). The results of paired t-test suggest that there was significant (p<0.05) increase in EMG activity during the Empty can position mean score 2858.3 (+917) when compared to Prone full can test position mean score 3091.6 (+994). (Table no.4) (Fig.no.7)
### Table 4: Comparison between the Empty can and Prone full can Test Positions

<table>
<thead>
<tr>
<th>Test positions</th>
<th>Mean ± SD</th>
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<td>Empty Can</td>
<td>2858.3 ± 917</td>
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<td>Prone Full Can</td>
<td>3091.6 ± 994</td>
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</table>

S- Significant (p<0.05)

### Post Hoc Turkey Test

Post HocTurkey analysis was done among the test positions Full-can, Empty-can and Prone full-can for EMG activity of supraspinatus muscle. The results of Post HOC Turkey test suggests that the maximum EMG activity was in Prone Full-can position followed by Full-can position and then Empty-can position. Hence, Prone full-can test position showed the greatest amount of EMG activity among the three test positions but there was no significant difference(p>0.05) between Prone full-can and Full-can test positions. (Table no.5)

<table>
<thead>
<tr>
<th>Test positions</th>
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<td>Full Can Vs Prone Full Can</td>
<td>73.7</td>
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<tr>
<td>Empty Can Vs Prone Full Can</td>
<td>233.3</td>
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</table>

S- Significant (p<0.05)

NS- Non Significant (p>0.05)

### DISCUSSION

In this study there was significant difference(p<0.05) in the EMG activity of supraspinatus muscle among the three different test positions. Prone Full-can position showed maximum EMG activity of supraspinatus muscle followed by Full-can position and then Empty-can position. The results of this study confirm the results of study conducted by Blackburn et al, who suggest that there is statistically significant increase in supraspinatus activity during prone horizontal abduction at 1000 with full external rotation or prone full can position.

In a detailed study of EMG activity of the rotator cuff and deltoid musculature in normal subjects and patients with shoulder impingement, significant decreases in supraspinatus and infraspinatus activity in subjects with impingement were found. Prone horizontal abduction is used to minimize the effects from subacromial contact. Research has shown this position to create high levels of supraspinatus muscular activation making it an alternative to the widely used ‘empty can’ exercise, which can often cause impingement due to the combined inherent movements of the internal rotation and elevation. The empty can exercise is no longer recommended in the rehabilitation of patients with rotator cuff pathology.

Worrel et al, also supported the results of this study reporting that the horizontal abduction exercise produce significantly greatest amount of EMG activity in the supraspinatus muscle when compared with empty-can exercise thus allowing better contraction of supraspinatus.

Similar findings were observed by Michael M.Reinold et al, in his study that the greatest activity for the supraspinatus (82%) was observed during prone horizontal abduction at 1000 of abduction and full ER.

### CLINICAL SIGNIFICANCE

Results from this study provide muscle activity patterns which can help clinicians choose the exercises in that position that fits best for better rehabilitation of the patient as well as initial information to develop rehabilitation programs for strengthening the supraspinatus muscle and injury prevention programs.
CONCLUSION

It can be concluded from the results of the study that there was significant difference \( p<0.05 \) in EMG activity of supraspinatus muscle in three different test positions. Prone full-can test position showed highly significant increase in EMG activity among the Full-can and Empty-can test positions.

REFERENCES

EFFECTIVENESS OF PHONOPHORESIS, PRESSURE RELEASE AND LASER IN THE UPPER TRAPEZIUS MYOFASCIAL TRIGGER POINT: A RANDOMIZED CLINICAL TRIAL

Ajoy Daniel Rai*, Nikita Joshi**, Pratik Chettri***

Objectives: The objective of the study is to compare effectiveness between Phonophoresis, Pressure release and LASER in upper trapezius myofascial trigger point.

Methods: Total 60 samples were taken and they were randomized into three groups. Phonophoresis with hydrocortisone, pressure release, LASER as a treatment was given to three groups respectively. VAS (visual analogue scale), neck disability index questionnaire, and pressure algometer (for pain pressure threshold) were used as outcome measures.

Results: Statistical analysis through ANOVA revealed that there was presence of statistically significant difference within all three groups for neck disability index questionnaire (< 0.05), VAS (< 0.05), PPT (< 0.05). In pressure release group neck disability score and VAS decrease significantly more than in other two groups but there was no significant difference in PPT when compared to other two groups.

Conclusion: Pressure release can be used as an effective short term treatment regimen in the management of upper trapezius myofascial trigger point over LASER and Phonophoresis with Hydrocortisone.

Keywords: Pressure release, Phonophoresis, LASER, ultrasound, hydrocortisone,

INTRODUCTION

The trigger point is a region of metabolic distress that is already deficient in energy1. Myofascial trigger point (MTP) is a hyperirritable nodule of spot tenderness in a palpable taut band of skeletal muscle that can refer pain to a distant point and also causes distant motor and autonomic effects2, 3. The upper trapezius is probably the muscle most often beset by myofascial trigger point4. Many daily activities involves persistent elevation of the shoulders sometimes habitual postures or repetitive activities placing abnormal stresses that produces upper trapezius overload1, 3.

Trigger points can be categorized as either active or latent5. Active trigger points are those that cause pain at rest or with activity of the muscle containing the trigger point. A latent trigger point does not cause pain, but may cause restricted movement and weakness of the muscle containing the trigger point6.

Therefore, the diagnosis of myofascial trigger points is dependent on manual palpation skills and patient feedback6. Pressure at the trigger points causes a "jump sign. The various treatment techniques that are utilized for treating trigger points are LASER, trigger point injection, spray and stretch method, dry needling, ultrasound, TENS, trigger point pressure release/ischemic compression, muscle energy technique (MET), myofascial release therapy, positional release therapy1, 2, 3, 6 etc.

Previous study has shown that the efficacy of therapeutic technique has found to be effective when modalities are combined with manual therapy techniques or exercises. There is a limited study supporting the effectiveness in myofascial trigger pain using only modalities or only manual therapy techniques. The objective of the study is to compare effectiveness between Phonophoresis, Pressure release and LASER in upper trapezius myofascial trigger point.

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** Associate Professor, Sikkim Manipal College of Physiotherapy.
*** Lecturer, Sikkim Manipal College of Physiotherapy.
METHODS:

Procedure:
After the ethical committee of the institute accepted the research proposal, a notice was circulated to Department of Orthopedics Central Referral Hospital, notice board of college and schools, office workers and computer workers in government and private sectors in Sikkim. The notice informed about the study and requested to refer or join if they were suffering from myofascial pain. Once the subjects came to physiotherapy department, preliminary screening of subjects was done and those who met the inclusion criteria were included in the study. Inclusion criteria were presence of a palpable taut band in the upper trapezius muscle, presence of a nodule, presence of at least 1 hypersensitive tender spot in the taut band in response to 25N of pressure and presence of jump sign. Exclusion criteria were diagnosis of fibromyalgia syndrome, history of whiplash injury, history of cervical spine surgery, subjects with congenital and acquired spinal deformities, individuals with neuromuscular entrapment or compression syndrome of cervical spine, diagnosis of cervical radiculopathy or myelopathy determined by the primary care physician, subjects with any space occupying lesion in neck and shoulder region, subjects with any systemic disorder, hypersensitivity and cognitive difficulties.

They were explained about the study and informed consent form was taken. Randomization was done with chit system. Total 60 samples were taken and they were randomized into three groups equally. Phonophoresis with hydrocortisone, pressure release, LASER as a treatment was given to three groups respectively. Therefore each group had 20 subjects each.

Before treatment trigger point was identified and marked with a marker. All groups were treated for 5 days a week. Pre-treatment assessment using VAS (visual analogue scale), neck disability index questionnaire, and pressure algometer (for pain pressure threshold) were taken before the session 1st, 3rd and 5th day. Follow-up assessment was taken after 1 week for all three groups. The entire procedure is described through flow chart as in the figure below:

Intervention:

Pain pressure threshold:
All patients were asked to lie down in a prone position, and the neck was placed in a neutral position during the study. Pain pressure threshold was measured with a digital algometer consisting of a 1-cm wide disk that was pressed vertically on the myofascial trigger points. This procedure was performed 3 times with 10-second intervals, and the average value was determined as PPT13.

Pressure Release:
All patients were asked to sit on a chair, and the neck was placed in a neutral position. Thumb of therapist was put on the myofascial trigger point and pressure equal to the average PPT was exerted. Pressure was applied slowly and released slowly for best results. The pressure was maintained until there was a change in pain and was held approximately for about 90 seconds13.

Figure 1: pressure release

Phonophoresis with hydrocortisone:
Patients were positioned in high sitting with back rest chair & forearm well supported. Before the start of treatment, the therapist thoroughly cleaned the subject's skin with alcohol rub, and after specifying the concerned point, a gel with 1% hydrocortisone was applied over the myofascial trigger point. Ultrasound dose was continuous mode; 1MHz, 0.5watts/cm², for 5min. During the treatment, the ultrasound applicator was moved rotationally on
the myofascial trigger point with similar speed and pressure for all subjects. The myofascial trigger point with similar speed and pressure for all subjects.

**Figure 2: Phonophoresis with hydrocortisone**

**LASER:**
Patients were positioned in high sitting with back rest chair & forearm well supported. Infrared LASER Probe with 0.5 cm beam diameter, Wave length-904nm, mode - continuous, Dose- 5J/cm² and with Penetration depth- 2cm was applied over the trigger point for 3 min.

**Figure 3: LASER**

**Statistical analysis:**
- ANOVA was done for within group and between group analysis using SPSS 19.
- Multiple comparisons within the groups were done through bonferroni post hoc test.

**RESULTS:**
Statistical analysis through ANOVA revealed that there was presence of statistically significant difference within all three groups for neck disability index questionnaire (< 0.05) PPT increased significantly in all 3 groups. There was a significant decrease in VAS and neck disability score in all three groups.

**Table 1: Pressure Release within group analysis**

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<th>SESSION-1</th>
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<td>VAS</td>
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<td>&lt; 0.005</td>
<td>10.4 **</td>
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**Figure 4: Pressure Release within group analysis**
The overall effect of pressure release was superior to LASER and phonophoresis with hydrocortisone. In pressure release group neck disability score and VAS decrease significantly more than in other two groups but there was no significant difference in PPT when compared to other two groups (fig.7,8,9).
There is not much difference in overall effect between LASER and phonophoresis.

**DISCUSSION:**
The purpose of this study was to compare effectiveness between Phonophoresis with hydrocortisone, pressure release and LASER in upper trapezius myofascial trigger point with 5 days of treatment. The present study showed that all three treatments LASER, phonophoresis with hydrocortisone and pressure release were effective for treatment of upper trapezius myofascial trigger points. But pressure release was the most effective in treatment of upper trapezius myofascial trigger point.

The present study supports the study done by Gary Fryer and Laura Hodgson where they found out that there was a significant increase in the mean PPT of myofascial trigger points in the upper trapezius following manual pressure release, but not following the sham treatment. It also supported the finding of Hou Ru Chuen et al and Hanten P. W et al that pressure release provides immediate pain relief and reduces the myofascial trigger point's sensitivity of the cervical myofascial pain.

Positive effect of pressure release may be because after pressing the myofascial trigger point, ischemia was created, and when that pressure was released, a sudden increment in local blood flow was inevitable. Consequently, increasing local blood flow may clean out pain-producing substances from the area, and stimulation of pain receptors may be reduced accordingly. Releasing anesthesia hormones such as endorphin and encephalin after removing pressure from the myofascial trigger point site, neurologic inhibition, and gate control theory might be other mechanisms proposed for pain reduction and removal of relative symptoms after using pressure release in the present study.

The present study supports the finding of Javad Sarrafzadeh, Amir Ahmadi and Marziyeh Yassin in which they treated 60 female patients with upper trapezius latent myofascial trigger point with phonophoresis with hydrocortisone, pressure release and ultrasound in 3 different groups and found out significant improvement in these 3 groups than the control group. They have concluded that pressure release and phonophoresis with hydrocortisone have more significant...
therapeutic effect than ultrasound. This anti-inflammatory property of hydrocortisone along with the mechanical effects of ultrasound might be the reason behind pain reduction in phonophoresis with hydrocortisone group in the present study.

The present study supports the systemic review done by Howard Vernon and Michael Schneider where they found strong evidence for LASER as a treatment of myofascial trigger point15. It also supports the finding of Aral et al, Sibby et al and Abeer A. Yamany and Samir Elsaid Salim. They found LASER to be very effective in treating myofascial trigger point in upper trapezius and shoulder16, 17, 18.

Significant reduction in pain in LASER group might be due to the increase in the local microcirculation in the trigger point area and washout of pain substances. It has been proposed that LASER may improve the oxygen supply by increasing the microcirculation16. The other mechanisms may be related to its effects on endorphin levels and gate control theory of pain. By all these mechanisms, Laser can interrupt the vicious cycle of pain17. Mechanism whereby LASER relieves pain is unknown. The analgesic effects of LASER may be due to release of local neurotransmitters such as serotonin, increase mitochondrial ATP production, increase release of endorphins or anti-inflammatory effects and by reducing interstitial swelling by stimulating the motoricity of lymphatics17.

In present study pressure release had superior effect than LASER. Earlier studies showed that LASER and pressure release were equally effective in reducing pain and increasing function16. This may be due to the inclusion of stretching technique and exercise along with LASER in earlier studies16, 17, and 18.

Earlier study has shown that pressure release and phonophoresis with hydrocortisone were equally effective in myofascial trigger point13. But the present study shows that pressure release is more effective than phonophoresis with hydrocortisone in treating myofascial trigger point. This couldn’t be explained why phonophoresis with hydrocortisone was not able to elicit the outcome similar to pressure release. As the number of sessions and duration is different between the present study and the earlier study, the short duration and less session could be responsible for the change. Further study is required to compare the effectiveness of phonophoresis with hydrocortisone and pressure release.

**Limitations:**

There were few limitations in the study which includes lack of a control group, sample size was small and short term effect of therapeutic benefits with only 1 week of follow up. Heterogeneous sample characteristics were taken and ratio between male and female in each group was not equal.

**Scope for future studies:**

Scope for future studies is to increase follow up duration and number of sample size using more homogeneous characteristics. This study could be repeated with an additional group undergoing placebo therapy to rule out the fact that pain relief could have been due to time factor.

**CONCLUSION:**

Pressure release can be used as an effective short term treatment regimen in the management of upper trapezius myofascial trigger point over LASER and Phonophoresis with Hydrocortisone.

**REFERENCES:**

5. Gemmell H, Miller P, Nordstorm H. Immediate effect of ischemic compression and trigger point pressure release on neck


24. Joanne Borg-Stein. Treatment of


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