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EFFECTIVENESS OF YOGA IN CHEST EXPANSION FOR INTERSCAPULAR PAIN IN FEMALE ADOLESCENT – A CASE STUDY

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ABSTRACT

Siddha system of medicine is one amongst the ancient system of medicine practicing in southern part of India especially in Tamilnadu and Kerala. Siddha mainly deals with the kayakarpam which play a vital role in preventing ageing and the characters of ageing. Siddhars were ever young and healthy. They analysed the important drugs for a strong physique and had wonderful medicines with them to keep the body imperishable. The important one among kaayakarpam is yogam(yoga). The word Yoga means to bind or join. It also means union or communion. It was collated, co-ordinated and systematized by Saint Patanjali in his classical work, the Yoga Sutras. The third and fourth limb of Astanga yoga is Asana or posture, Pranayama or breathing exercise. Asana bring steadiness, health and lightness of limb. Asanas help to exercise every muscle, nerve and gland in the body. Prana means breath, respiration. Aayaama means length or expansion. There are various types of Pranayama which helps in increasing the lung capacity and also help in chest expansion. Nowadays due to over use of gadgets and sedentary lifestyle there is increase in incidence of postural abnormality which can lead to Interscapular pain and reduced chest expansion in 3 levels. Yogasana practice improves posture and postural awareness which increases the chest exapansion in 3 levels. Recent studies shows that there is increasing incidence of interscapular pain in female adolescent. This article deals with the interscapular pain and increasing chest expansion in female adolescent with intervention of yogaasanas and Pranayama.

KEYWORDS: Siddha medicine - Yoga Therapy, Physiotherapy - Myofascial trigger points.

INTRODUCTION

According to the International Association for the Study of Pain, Pain is defined as "an unpleasant sensory and emotional experience associated with actual or potential damage of tissues, or described in terms of this".[1] Spinal pain is a well-recognised condition associated with significant personal and community burdens. The most common spinal regions studied are the lumbar and cervical spine, probably because of their strong and well-established associations with pain conditions, work-related injuries, intervertebral disc degenerative conditions, head-aches and psychosocial disturbances.[2,3] Compared to the lumbar and cervical spine, the thoracic spine has received less attention in terms of clinical, genetic and epidemiologic research[4,5], yet pain experienced in the thoracic spine can be equally disabling, imposing similar burdens on the individual, community[6,7] and work-force.[8]

The thoracic spine pain (TSP) is the pain experienced in the region of the thoracic spine, between the boundaries of T1–T12 and across the posterior aspect of the trunk. Thoracic pain is most common in childhood, whereas thoracic pain and lumbar pain are equally common in adolescence.

Among the different structures that can refer pain to the thoracic spine, muscles often play a relevant role. Trigger points (TrPs) from neck, shoulder and spinal muscles can induce pain in the region of the thoracic spine. There is a lack of evidence reporting the presence of TrPs in the region of the thoracic spine, but clinical evidence suggests that TrPs can be a potential source of thoracic spine pain. The prevalence of thoracic spine pain is higher in women than in men with a female-to-male ratio of 2:1.

Yoga

Yoga exercises strengthen and increase tone of weak muscles and help with conscious control over autonomic functions of the body. Yoga postures, called Asanas, help with developing correct breathing patterns, bowel habits, and regular sleeping patterns. It teaches the art of relaxation, relieving muscular and nervous tension and leads to increased energy. Asanas means ‘‘posture’’ in Sanskrit. Yoga-asanas involve standing, sitting, kneeling, lying, balancing, inverted positions, stretching, twisting, and contraction and relaxation of muscles, producing a steady posture at a given time. It is important to start yoga practices at a slow pace with slow, smooth, steady coordinated movements with full control at every stage. A

regular routine is as essential as the intensity of Asanas. It is beneficial to perform asanas in a quiet, well-ventilated area with the least distraction and free of dust and cold breeze.

Myofascial pain syndrome (MPS) and Myofascial trigger points (MTrPs)

Myofascial pain syndrome (MPS), a common type of nonarticular musculoskeletal pain, is a condition associated with regional pain and muscle tenderness characterized by the presence of hypersensitive nodules, also called myofascial trigger points (MTrPs).[9]

Typically, MTrPs are painful on compression and can give rise to referred pain and/or tenderness, as well as autonomic phenomena (localized sweating, vasoconstriction or vasodilation, and pilomotor activity).[10,11]

The leading belief is that MTrPs are caused from an excessive release of acetylcho-line (Ach) from motor endplates.[12,13] The prolonged release of Ach results in chronic shortening and contractures of sarcomeres, coupled with decreased circulation leading to hypoxia and local ischemia. As a result, prostaglandins, bradykinins, cytokines, and histamine are released, which then sensitize the sensory afferent nerve fibres of the muscle, likely accounting for the specific point tenderness commonly seen with MTrPs.[14,15]

MPS negatively impacts function and participation in life activities. There are two categories of trigger points, active or latent, that may develop within a skeletal muscle. Active trigger points are spontaneously active and produce local or referred pain to remote structures. Latent trigger points, however, are not spontaneously active and would not produce any symptoms unless being evoked by an external stimulant.

Rhomboids muscle and Serratus posterior superior trigger points

Pain referred from trigger points (TrPs) in the rhomboid muscles concentrates along the vertebral border of the scapula between the scapula and the paraspinal muscles (T3-T7). The pain also may arise by the sustained stretch position imposed by round shouldered posture, by tense, shortened pectoralis major muscles, or by reaching forward or stretching down to reach something. The TrPs can be activated and perpetuated by prolonged leaning forward and working in a round-shouldered position (as when writing or sewing and not leaning back against a back support), Myofascial TrPs in the rhomboid muscles are activated by holding the arm in abduction or flexion above 90° for a pro-longed period, as when painting overhead.[16] The interscapular pain caused by serratus posterior superior trigger points can be

particularly annoying and distressing, partly because it can be so persistently intense, partly because it is so refractory to positional relief.

Function of the Rib cage

The human rib cage is a component of the human respiratory system. It encloses the thoracic cavity, which contains the lungs. An inhalation is accomplished when the muscular diaphragm, at the floor of the thoracic cavity, contracts and flattens, while the contraction of intercostal muscles lift the rib cage up and out. Expansion of the thoracic cavity is driven in three planes; the vertical, the anteroposterior and the transverse. The vertical plane is extended by the help of the diaphragm contracting and the abdominal muscles relaxing to accommodate the downward pressure that is supplied to the abdominal viscera by the diaphragm contracting. A greater extension can be achieved by the diaphragm itself moving down, rather than simply the domes flattening. The second plane is the ***anteroposterior*** and this is expanded by a movement known as the ***'pump handle.'*** The downward sloping nature of the upper ribs are as such because they enable this to occur.

When the external intercostal muscles contract and lift the ribs, the upper ribs are able also to push the sternum up and out. This movement increases the anteroposterior diameter of the thoracic cavity, and hence aids breathing further. The third, ***transverse, plane*** is primarily expanded by the lower ribs (some say it is the 7th to 10th ribs in particular), with the diaphragm's central tendon acting as a fixed point. When the diaphragm contracts, the ribs are able to evert and produce what is known as ***the bucket handle movement***, facilitated by gliding at the costovertebral joints. In this way, the transverse diameter is expanded and the lungs can fill.

The circumference of the normal adult human rib cage expands by 3 to 5 cm during inhalation.

Thoracic Vertebrae

In vertebrates, **thoracic vertebrae** compose the middle segment of the vertebral column, between the cervical vertebrae and the lumbar vertebrae.[1] In humans, there are twelve thoracic vertebrae and they are intermediate in size between the cervical and lumbar vertebrae; they increase in size going towards the lumbar vertebrae, with the lower ones being a lot larger than the upper. They are distinguished by the presence of facets on the sides of the bodies for articulation with the heads of the ribs, as well as facets on the transverse

processes of all, except the eleventh and twelfth, for articulation with the tubercles of the ribs. By convention, the human thoracic vertebrae are numbered T1–T12, with the first one (T1) located closest to the skull and the others going down the spine toward the lumbar region.

Some people with upper or mid-back pain feel pain when they sneeze or cough. Similarly, you may also feel upper back pain when you take a deep breath because the vertebrae (the spinal bones) in your upper back (also known as the thoracic spine) are connected to the ribs. Though upper back pain symptoms generally occur anywhere along the spine between the base of the neck (cervical spine) and bottom of the ribs, you may also feel upper back pain in your shoulders and neck. That's because all your muscles are connected, so if it's a muscle problem causing your upper back pain, the other muscles in your shoulders and neck can be affected. Anyone who uses a backpack may be at risk for upper back injury and pain. An over-loaded backpack can be dangerous to the spine, but so is not wearing the backpack correctly.

AIM OF THE STUDY

To evaluate the effectiveness of yoga in chest expansion for interscapular pain in female adolescent.

OBJECTIVE

To find the effectiveness of Yoga in chest expansion and its relation with interscapular pain in female adolescent.

MATERIALS AND METHODS

16years, Female adolescent was approached and was instructed to participate in the yoga therapy session. Yoga session composed of initial prayer, loosening exercises, Asanas, pranayama, relaxation techniques, final prayer were practiced in the morning session. Subject's demographic data required for the study, was obtained through a questionnaire. Informed consent was sought from the subject and her guardian.

Yoga therapy session started from the 1st day to the 45Th day for 60 minutes per day. The subject was given a yoga session 7 days per week. The subjects were advised to practice only vibagiya pranayama for 5 days during their menstrual period.

Outcome Measures

❖ **Interscapular pain perception using Visual Analogue Scale (VAS)**

For pain assessment VAS was used, graduated from zero to ten, where zero means no pain and ten means severe pain, being applied before and after. Pre VAS was taken on the first day of yoga therapy session, and post VAS was taken on the 45th day, to grade the severity of the thoracic spine pain to know the treatment benefit.

❖ **Chest excrusion using Inch tape**

Study was carried out with subject in standing position, elbows slightly flexed so that the hands rested on hips. Chest excursion is measured before starting the yoga session on the 1st day and the final measurement was taken on the post yoga session on the 45th day on 3 levels (i.e., Axilla, Nipple, Xiphisternum levels) for the subject by another person who was blinded. The tape was snug but not tight, so that the soft-tissue contours remained unchanged. The difference in measurements between maximum inhalation and maximum exhalation was used as the measure of chest expansion [Susan E. Bockenhauer et al, 2007]. Three trails were given at each level and average of three readings was noted. Measurements were taken in millimeter (mm). All the measurements were done by the same blinded physician.

YOGA SESSION

The subject was asked to follow the given instructions during the yoga sessions.

Asanas

❖ Padahasthasana
❖ Sethubandhasana
❖ Marjarasana
❖ Bhujangasana
❖ Arthapincha mayurasana
❖ Adhomukhasvanasana
❖ Vajrasana
❖ Matsyasana
❖ Salamba bhujangasana
❖ Dandasana
❖ Ushtrasana
❖ Purvottanasana
❖ Urdhvamukhasvanasana

- Savasana

During the asana practice, after achieving the final pose, the subject is advised to maintain the normal breathing pattern without breath retention (kumbhaka).

Pranayama

- Vibhagiya Pranayama (sectional breathing)
- Adama Vibhagiya Pranayama (diaphragmatic/abdominal breathing)
- Madhyama Vibhagiya Pranayama (Thoracic/intercostal breathing)
- Aadya Vibhagiya Pranayama (upper lobar/clavicular breathing)
- Poorna mudra Pranayama (Full yogic breathing)

Relaxation techniques

- Instant relaxation techniques(IRT)
- Quick relaxation technique(QRT)
- Deep relaxation technique(DRT)

RESULT AND DISCUSSION

S.no	Age / sex	Pre dal (mm)	Post dal (mm)	Pre dnl (mm)	Post dnl (mm)	Pre dxl (mm)	Post Dxl (mm)	Pre vas	Post vas
1.	16 / Female	15	30	20	25	15	25	7	2

DAL = Difference in Axillary Level: DNL = Difference in Nipple Level

DXL = Difference in Xiphi sternal level: VAS = Visual Analogue Scale

The pre VAS of the subject on day 1, before the yoga session was graded as 6 and the post VAS of the subject on 45th day after yoga session was graded as 3. This shows the siginificant reduction in interscapular pain perception. The difference in chest excrusion of the subject on day one, before the yoga session was the difference of 15 mm in Axillary level, 20mm in Nipple level and 15mm in Xphisternal level. The difference in chest excrusion of the subject on 45th day was measured. The difference in Axillary level was 30mm, the difference in the Nipple level was 25mm and the Difference in the Xphisternal level was 25mm. from the above differences in 3 levels on the 1st and 45th day, it is understood that there is a considerable increase in the chest excrusion level. Comparing to the two levels axillary level shows profound increase in the chest excrusion level, which could be due to the decreased interscapular pain perception. By which it can be clearly stated that there is a relation ship between the chest excursion and interscapular pain perception.

Yoga improves lung function through both postural correction and breath retraining. A slumping posture pushes the bottom ribs into the abdomen, restricting rib movement and further limiting the amount of air taken in. the lungs will have less space to expand if there is thoracic kyphosis. The better posture that yoga encourages will open the region of lower ribs and learning to use the abdominal muscles to exhale fully, which allows to take more air in the subsequent breath. Chest wall excursion measurements give us a measure of chest wall mobility. Measurement of the chest expansion can be assessed objectively by non-stretchable inch tape. There are two movements of the thoracic cage. The upper chest movement is described as pump handle movement known to increase the antero-posterior diameter of the chest whereas lower chest movement is called as Bucket handle movement known to increase the transverse diameter of the thorax.

One of the optimal breathing patterns is diaphragmatic—deep, smooth, even, quiet, and free of pauses, involving exhalation and inhalation. In yogic tradition, voluntary control of breathing has long been used to foster self-awareness and reduce autonomic reactivity.[17]

Vibhagiya Pranayama (sectional breathing) practice increases thoracic-pulmonary compliances by more efficient use of diaphragmatic and abdominal muscles, thereby emptying and filling the respiratory apparatus more efficiently and completely. In addition, general principles of yogic breathing can change breath habitually from chest breathing to abdominal breathing pattern. Abdominal breathing uses the diaphragm primarily, and is congruent with the shape of the lungs and the capacities of the breathing muscles. The diaphragm is the primary muscle of respiration, and when the diaphragm contracts and its dome descends, pressure within the thorax falls enough to draw air into the lungs, simultaneously altering the shape of the abdomen and the rib cage, causing the anterior abdominal wall, the sides, and the lower back to expand. By regular practice, misuse of accessory muscles is eliminated.[17]

Yoga exercises strengthen and increase tone of weak muscles and help with conscious control over autonomic functions of the body. A type of Yoga, the Asanas, involves a variety of effects including (1) relaxation, stretching, and balancing of muscles; (2) mobilization of joints; 3) improvement of posture; (4) action on pressure points; (5) improvement of breathing; (6) calming of the nervous system; and (7) promotion of homeostasis in cardiovascular, digestive, endocrine and other systems.[19]

The Asanas relaxes muscles through holding them in gently stretched positions[19]. As another benefit, Yoga improves posture. Appropriate posture improves breathing because the chest is opened up (Halvorson, 2002), which stretches the tight pectorals muscles so that the overworking rhomboidus muscles are relaxed. Yoga increase the health of the back by building holistic strength, increasing flexibility, and improving alignment, the health of your entire body will benefit. From this study we can understand that as the decrease in interscapular pain which had a profound effect in the chest excursion in the axillary level compared to the other 2 levels. The reduction in the interscapular pain may be due to the influence of postural correction and also due to the improved mobility in the cost vertebral and costo transverse joints attached to the upper thoracic spine in the interscapular region (T3-T7), due to the decreased activity of myofascial trigger points.

In summary, the present study suggests that short-term Yoga therapy improves chest wall excursions. These data provide more scientific evidence to support the beneficial effect of Yoga practice on respiration and myofascial trigger points.

CONCLUSION

The present study suggests that a 45 days of yoga session had significant effect on improving chest expansion in all three levels by reducing the interscapular pain perception caused due to the myofascial trigger points in adolescent female through a variety of effects including relaxation, stretching, and balancing of muscles, mobilisation of joints, improvement of posture and breathing. Compared with other two levels, chest excursion in the axillary level showed a considerable difference in the excursion measurements, which can be due to the influence of reduced interscapular pain perception.

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