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Addressing Combined Scoliosis and Kyphosis in Adolescents: Musculoskeletal Challenges and Physical Therapy Interventions

Khushi Surana[1], Shilpa Chourasia[2], Kiran Mendhe[3]

[1]Post Graduate Student, Musculoskeletal Physiotherapy
VSPM's College of Physiotherapy, Nagpur, Maharashtra, India
suranakhushi887[at]gmail.com

[2]Professor, HOD Musculoskeletal Physiotherapy
VSPM's College of Physiotherapy, Nagpur, Maharashtra, India
drshilpahatewar[at]gmail.com

[3]Associate Professor, Musculoskeletal Physiotherapy
VSPM's College of Physiotherapy, Nagpur, Maharashtra, India
kjanbandhu[at]yahoo.co.in

Abstract: ***Background: Scoliosis is defined as an appreciable lateral deviation in the normally straight vertical line of the spine. The ultimate effect of the disease is a major cosmetic deformity and poor health due to cardiorespiratory changes. Kyphosis is defined as abnormally increased convexity in the curvature of the thoracic spine as viewed from the side. This can cause physical discomfort, pain and altered biomechanics of the scapulothoracic muscles, pectoral muscles and neck muscles. Method: In this prospective case report, a 13-year-old female patient with cosmetic deformity in the upper thoracic region was presented. Conservative management of the patient was done with addition of strong surged faradic stimulation over the scapular muscles along with scapular PNF to recruit and improve the efficiency of the scapular muscle. Conclusion: Conventional protocol including scapular muscles training along with strong surged faradic stimulation, scapular PNF and an effective home-exercise program show the positive results.***

Keywords: Scoliosis, Kyphosis, Scapular PNF, Faradic stimulation

1. Introduction

Adolescent idiopathic scoliosis is defined by as a lateral curvature of the spine (Cobb angle) of at least 10 degrees in the absence of underlying congenital or neuromuscular abnormalities, which affects the children of age group 13-18 years.[1]It is a three dimensional deformity of the spine and rib cage.[2] The prevalence of AIS is known to be 0.47–5.2 % in the current literature.[3] The contributing factors in development of AIS includes body mass index (BMI), physical activity (PA), gender, time of the first menstrual cycle and also genetic factors.[3][4]

Kyphoscoliosis is defined as a combined abnormal curvature of the spine in both the sagittal (kyphosis typically >50 degrees) and coronal (scoliosis) planes, often accompanied by axial rotation of the spinal column and affects thoracolumbar region. Children with kyphoscoliosis often present asymptomatically, with concerns typically raised by caregivers noticing physical asymmetries, e.g., uneven shoulders or hips, prominence of the spine or scapula, an uneven waistline, or changes in gait. [5]

The kyphotic deformity is frequently attributed to "poor posture," resulting in delayed diagnosis and treatment which can produce neurological symptoms and progresses to a significant degree when remains untreated. [6][7] Kyphoscoliosis could be associated with a hump in the thoracic area lowers which undermines confidence in addition to being a cosmetic defect. The objective of this case study is to discuss about kyphoscoliosis in adolescent, early diagnosis and physiotherapy management.

2. Case Report

A 13-year-old, school-going female student was brought by her mother in physiotherapy OPD with complaints of cosmetic deformity and abnormal posture. Patient was normal and in growing age when her parents noticed she sits with a sloughed back now for almost last 4 years. They ignored the problem as she never complaint about any pain or discomfort. In February she got admitted in Lata Mangeshkar Hospital for removal of choledocholithiasis where doctor noticed a kyphotic hump in upper back and referred to physiotherapy department. Patient again came to physiotherapy OPD on 19/06/2025 after choledocholithiasis management. Since then, she's coming to physiotherapy OPD for treatment.

Clinical Examination

Posture Assessment in standing

The posture assessment follows the standard method where a plum line is used to record the deviation in frontal and sagittal plane. The alterations are described in table no. 1

Table 1: Alterations in Posture in frontal and sagittal planes

Cervico-caudal (sr.no.)	Anterior View (Frontal Plane)	Posterior View (Frontal Plane)	Lateral View (Sagittal Plane)
1.Neck and head	slightly lateral flexed to right side	right ear is not at same level as left	forward head present with increased cervical lordosis (upper lordosis diminished, lower cervical lordosis exaggerated)
2.Shoulder	protracted and rounded shoulder with loss of shoulder contour	right shoulder is depressed	---
3.Thoracic spine	---	---	increase thoracic kyphosis and a thoracic hump is present
4.Lumbar Spine	---	---	flattening of lumbar spine present
5.Hip and ASIS	Bilateral ASIS not at same level	Bilateral PSIS not at same level	A posterior pelvic tilt is present.
6. Lower limb	Unequal weightbearing (right > left)	Unequal weightbearing (right > left)	flexed knee posture

Deformity assessment –

A C-shaped curve is visible on the mid thoracic level in sagittal and posterior view with a convexity of right side on palpation. The curve is starting at T3 and ending at T6. Adams bent test was performed to check the flexibility of the curve and the results are shown in Figure 1.

Figure 1: Demonstrates Adam's bent test with a mild hump on right side.

X-ray Films

Radiological investigation Figure 2. And 3. further confirmed presence of deformity in the thoracic region.

Figure 2: PA view

Figure 2: Lateral view

Static scapular stability-

The results are represented in table 2

Table 2: Static scapular stability results using lenne's test

Static Scapular Orientation at 0-degree abduction	The root of spine of scapula of both left and right side coincides with T3 spinous process and inferior angle (left) of scapula coincides with T7 spinous process and inferior angle (right) of scapula coincides with T8

Dynamic scapular stability-

The results are represented in table 3 which shows the right scapula is abducted as compared to the left at 45 and 90 degrees of shoulder abduction.

Table 3: Dynamic scapular stability results using scapular slide test

Scapular stability at 45-degree abduction	Distance from root of spine of scapula to T3 spinous process Distance from inferior angle of scapula to T8 spinous process	**Left** 4 cm 6 cm	**Right** 6 cm 8 cm
Scapular stability at 90-degree abduction	Distance from root of spine of scapula to T3 spinous process Distance from inferior angle of scapula to T8 spinous process	**Left** 4 cm 6 cm	**Right** 6 cm 8 cm

Forward head assessment –Forward head was objectively evaluated using MB ruler software in which the value of cranio- cervical angle equal to **46.94 degrees,** which suggests the presence of forward head as represented in fig. 4

Figure 2: Demonstrates Forward head with MB ruler

Other assessment included range of motion of all the joints, strength, thoracic expansion and exercution, tightness of pectoralis major and minor, hamstring, iliopsoas and gastrocnemius, limb length discrepancy, deep cervical flexor (CCFT), lumbar endurance and an outcome measure SRS-22 Scoring for measuring quality of life across different domains.

Goals were prioritized which included patient education regarding the condition and progression, postural and body awareness, increase in mobility of all the shortened muscles and strengthening of all the weaker muscles.

3. Intervention

A three-week intervention program was designed which included conventional exercise regimen, strong surged faradic stimulation and scapular PNF techniques.

Week one: Patient and guardian education regarding the importance and role of physiotherapy in her condition. Trigger release for trapezius and levator scapulae. MET for pectoralis major and minor and thoracic opening exercises.

Week two: Scapular retraction exercises. Hughston's exercises, PNF for scapular muscle retraining using hold-relax technique. Aerobic exercises such as brisk walking/spot marching Cervical and lumbar core activation. Strong Surged Faradic stimulation for middle trapezius and rhomboids.

Week three: Lower limb strengthening exercises. Hughston's exercises with theraband (minimum resistance). Cervical and lumbar core strengthening. Combination of isotonics PNF technique for scapular muscles.
Auto stretches for pectoralis major and minor and hip and knee musculatures

4. Results

Re-evaluation at the end of three weeks suggest improving scapular stability, normative cranio-cervical angle and significant postural changes.

5. Discussion

In the physical and emotional development of children, movement and postural pattern plays a very important role and this continues through adolescents. [8] It has been suggested that poor posture increases the strain on supporting structures and results in a less efficient balance of the body over the support base. [8] Postural control is dependent on inputs from the somatosensory, visual and vestibular systems. In cases where there is a curvature deformity and it is reasonably mobile, and the patient can change posture, the condition could be defined as non-structural or functional. Conservative treatment of the deformity could be more effective with much better improvements expected than in cases with a rigid spine.

Considering the impairments, we worked to increase the strength of scapular adductors, retractors while increasing the length of the shortened group of muscles like pectoralis major and minor and cervical extensors. Strong surged faradic stimulation was given in the initial days of treatment to recruit the scapular muscles. Strong surge faradic stimulation helps to activate the muscles which have been unused for a long duration of times, builds muscle memory and help increasing blood flow. Scapular PNF followed by stimulation for movement retraining and increasing the strength of the desired muscles gave the satisfactory results. To improve body awareness [8] as, commonly seen in kyphoscoliosis patients, exercises in front of the mirror, to use optimal visual feedback were performed. The visual cues not only helped her in giving feedback but also boost her confidence. Improving chest function was achieved through various therapeutic maneuvers like thoracic opening exercises, thoracic expansion exercises, reach out in quadruped etc. In the light of this knowledge, and as stated by Hawes, for non-surgical treatment of scoliosis, therapy methods based on exercises that increase and protect the flexibility of the spine might be useful. [8]

6. Conclusion

Scapular PNF, Strong surged faradic stimulation and visual cues exercise along with conventional exercise regimen assist in postural changes, reduce cosmetic deformity and boost confidence.

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Author Profile

Khushi Surana is currently a second-year postgraduate Musculoskeletal Physiotherapy student pursuing from VSPM's College of Physiotherapy, Nagpur. She completed her Bachelor of Physiotherapy from Sancheti Institute for Orthopaedics and Rehabilitation College of Physiotherapy, in the year 2024. With her keen interest and dedication in research, she believes in evidence-based practice for most appropriate palliative and holistic care for the patients.