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Case Report

Physiotherapy Section

Integrated Approach of Physiotherapy with Ayurveda in Management of Tethered Cord Syndrome: A Case Report

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ABSTRACT

Tethered Cord Syndrome (TCS) is a rare neurological condition caused by pathological anchoring of the spinal cord, resulting in abnormal stretching and progressive neurological deficits. Although TCS is commonly diagnosed in childhood, adult-onset cases present diagnostic and therapeutic challenges due to delayed recognition and varied clinical manifestations. The present case report describes a 38-year-old male presenting with chronic low back pain, progressive lower limb weakness and bilateral lower limb tremors, leading to impaired functional mobility and reduced quality of life. Magnetic Resonance Imaging (MRI) revealed thickening of the filum terminale, confirming the diagnosis of adult TCS. As the patient preferred conservative care, a 4-week integrated treatment program combining structured physiotherapy and Ayurveda interventions was implemented. Physiotherapy focused on pain relief, muscle strengthening, flexibility and functional rehabilitation, while Ayurveda therapies aimed to enhance neuromuscular balance and provide symptomatic relief. Clinical progress was monitored through periodic neurological and functional assessments. Following the intervention, the patient demonstrated significant improvements in pain intensity, muscle strength, lower limb tremors and overall functional performance, with no adverse effects reported. The present case suggests that integrative, non surgical management may be beneficial in adult TCS patients opting for conservative treatment and highlights the need for further controlled studies.

Keywords: Ayurvedic, Conservative treatment, Filum terminale, Low back pain, Physical therapy

CASE REPORT

A 38-year-old male presented with a 2-3 year history of low back pain, along with intermittent leg tremors associated with weakness since onset. The pain was localised to the lower back region. Pain intensity was assessed using the Visual Analogue Scale (VAS), with a pretreatment score of 8/10. Differential diagnoses such as lumbar disc herniation, spinal stenosis and degenerative disc disease were considered. However, the final diagnosis of TCS was confirmed based on MRI findings of the lumbosacral spine. Although surgical intervention was recommended, the patient opted for conservative management. The patient had no known co-morbidities. Patient underwent a structured physiotherapy rehabilitation program at Department of Physiotherapy, KLE Hospital, Karnataka, India, and simultaneously received Ayurveda treatment to complement his recovery.

On observation, posture assessment indicated lumbar lordosis contributing to increased mechanical stress on the lower back and lumbar spine. Also, the patient reported discomfort during forward bending and prolonged standing, with limited lumbar flexion and extension from last six months. MRI revealed structural abnormalities in the lumbosacral spine with degenerative changes which presents lumbar lordosis and low-lying conus medullaris with thickened filum terminale, thereby confirming the diagnosis of TCS [Table/Fig-1]. Clinical images of the patient were not included due to patient privacy considerations and lack of consent for photographic documentation; however, radiological findings (MRI) were used to confirm the diagnosis. Based on MRI findings, the present case was classified as congenital TCS due to a thickened filum terminale. Although congenital in origin, such cases may present in adulthood as symptoms can remain latent and manifest later due to progressive neural tension or triggering factors.

[Table/Fig-1]: T2-weighted MRI in a sagittal plane shows a low level conus medullaris at L2-L3 level with thickened filum terminale at l5 level.

The patient was not on any concurrent medications that could influence the outcomes and his occupational profile involving prolonged standing may have contributed to the condition.

Ayurveda Evaluation

The case can be diagnosed as *Asthimajjagata vata* (a condition involving vitiation of *Vata* affecting bone and bone marrow tissues) on the presenting symptoms:

Samprapti ghataka (components of pathogenesis) are Dosha - *Vata* (functional energy governing movement), *Dhatu- Mamsa* (muscle tissue), *Meda* (adipose tissue), *Snayu* (ligaments/tendons) and *Asthi* (bone), *Adhisthana- Sharir adaha baga* (lower part of the body), Agni - Vishamagni (irregular digestive/metabolic activity), *Srotas - Rasa* (circulatory channels carrying nutrients), *Raktaha* (blood channels), *Mamsavaha* (channels related to muscle tissue),

Srotodusti - *Margavarodh* (obstruction of channels) *Dhatuksaya* (tissue degeneration), *Vyadhi Swabava* - *Chirakari* (chronic in nature), *Sadhyaasadyta* - *Krichrasadya vyadhi* (disease that is difficult to treat), *Rogamarga* - *Madyama rogamarga* (disease affecting the intermediate pathway.)

The Ayurvedic classification of "*Asthimajjagata vata*" does not represent a direct anatomical equivalent of TCS in modern medicine. Rather, it reflects a conceptual framework describing functional disturbances involving the musculoskeletal and nervous systems. The features of *Asthimajjagata vata*, such as pain, weakness and neuromuscular dysfunction, show clinical similarity to symptoms observed in TCS. Therefore, this classification was used to guide therapeutic planning within the Ayurvedic paradigm, rather than to establish a direct structural or neuroanatomical correlation.

The complete protocol from initial presentation to follow-up assessment was for four months and six days [Table/Fig-2].

Event	Date	Details
Initial presentation and diagnostic confirmation	Baseline - Day 1	Patient presented with chronic low backache with bilateral lower limb weakness.
Duration of Ayurveda protocol	Day 4 - Day 35	*Panchakarma*: *Abhyanga*, *Swedana*, *Basti* (*Erandamooladi Niruha and Sahacharadi Anuvasana*), *Matra Basti*, *Kati Basti*
Duration of Physiotherapy protocol	Day 7 - Day 37	FITT principle-based exercise program; IFT, strengthening and stretching.
Follow-up assessment (1st, 2nd, 3rd)	Day 68, Day 99 and Day 127	1-month follow-up; no recurrence; sustained improvements. 2-month follow-up; further symptomatic improvement, no adverse effects. 3-month review; patient reported clinical stability and satisfaction.

[Table/Fig-2]: Timeline of integrated approach.

Integrated Therapeutic Intervention

The TCS was treated with four weeks protocol that included Ayurveda and physiotherapy approach.

All exercises were conducted under the direct supervision of a qualified physiotherapist to ensure proper technique, safety and progression according to individual tolerance. Standardised instructions and demonstrations were provided to maintain uniformity across sessions. Adherence was monitored through attendance records and session documentation, completing the full intervention protocol, indicating good compliance.

In physiotherapy, protocol was given by Frequency, Intensity, Time and Type (FITT) principle. The frequency of training was maintained at three days per week. The intensity was initially kept at low to moderate levels and was progressively increased over the subsequent weeks based on the patient's tolerance. Each session lasted for 40 to 50 minutes. The type of exercises included low-impact activities that were convenient, accessible and well tolerated by the participant [Table/Fig-3,4].

Clinical stability in the present case was supported by objective outcome measures, including improvement in pain scores (VAS), muscle strength {Medical Research Council (MRC) grading}, range of motion and functional disability {Oswestry Disability Index (ODI)}, with no evidence of deterioration during the follow-up period.

Ayurveda Intervention

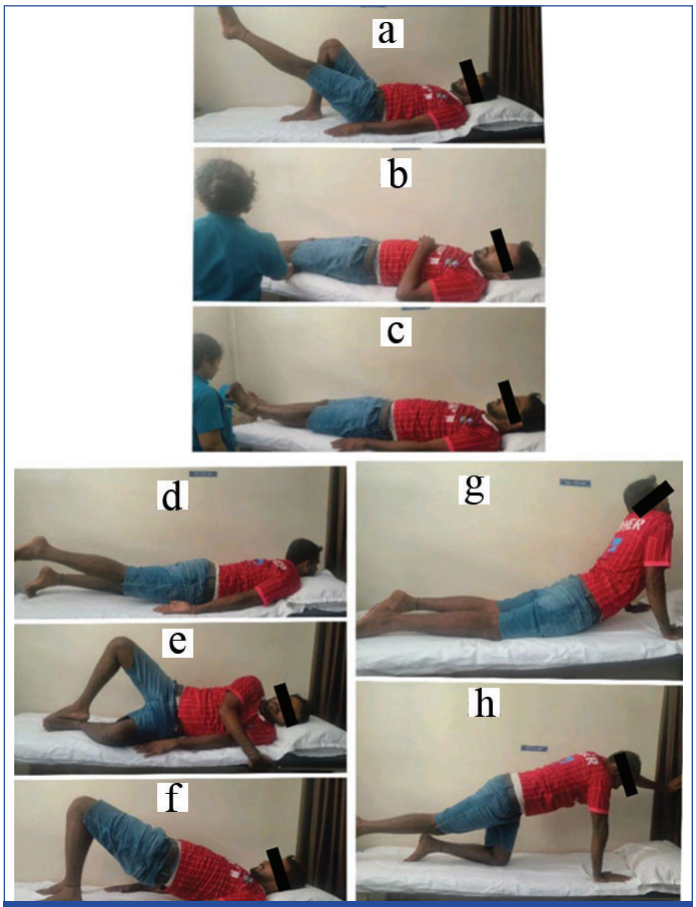
Considering the dosha, *dhatu* and other factors the patient was treated with oral medicines and *panchakarma* procedures [Table/Fig-5].

Follow-up and Outcomes

The effectiveness of the rehabilitation program was evaluated through pre- and postintervention assessments during session 1 and session 12 [Table/Fig-6]. Pain intensity was assessed using the

Exercise name	Week 1	Week 2	Week 3	Week 4	Follow-up - 3 months
Interferential Current (IFT)	10 minutes each session				Pain was decreased so no IFT.
Static quads and hams [Table/Fig-4b,c]	10 repetitions with half kg- 2 sets	10 repetitions with 1 kg weight - 2 sets	10 repetitions with 2 kg weight- 2 sets		Repetitions were progressively increased
Straight leg raises [Table/Fig-4a]					
Hip extension [Table/Fig-4d]					
Clampshell [Table/Fig-4e]	10 repetitions with theraband - 2 sets		20 repetitions with theraband - 2 sets		
Bridging [Table/Fig-4f]					
Bird dog [Table/Fig-4g]	5 repetitions - 1 set		10 repetitions - 1 set		Repetitions were progressively increased
Swan [Table/Fig-4h]					
Stretching of quadriceps, hamstrings and calf muscles	10 repetitions with 5 seconds hold - 2 sets		10 repetitions with 10 seconds hold - 2 sets		Repetitions and holding time were increased progressively.

[Table/Fig-3]: Physiotherapy intervention with progression.



[Table/Fig-4]: a) Straight leg raises; b) Static quads; c) Static hams; d) Hip extension; e) Clampshell; f) Bridging; g) Bird dog; h) Swan.

S. No.	Procedure	No. of days
1.	*Sarvanga Abhyanga* with *Dhanwantari taila*	10 days
2.	*Bashpa Sweda*	10 days
3.	*Yoga Basti* *Erandamooladi Niruha basti* Anuvasana *basti* with Sahacharadi taila	8 days
4.	*Matra Basthi* with *Ksheerabala taila*	10 days
5.	*Kati basti* with *Murivenna taila*	8 days

[Table/Fig-5]: Ayurveda treatment given to patient.

Outcome measure	Preintervention		Postintervention	
	Right	Left	Right	Left
Range of motion				
Lumbar flexion	40 degrees		60 degrees	
Lumbar extension	10 degrees		20 degrees	
Hip flexion with knee flexion	90 degrees	110 degrees	120 degrees	130 degrees
Hip extension with knee extension	15 degrees	20 degrees	25 degrees	25 degrees
Hip Abduction Hip Adduction	40 degrees 40 degrees	45 degrees 45 degrees	50 degrees 50 degrees	55 degrees 55 degrees
Knee flexion Knee extension	90 degrees	100 degrees	120 degrees	130 degrees
Manual Muscle Testing (MMT)				
Hip flexors Hip extensors	3	3	5	5
	2	2	4	4
Hip abductors Hip adductors	3	3	4	5
Knee flexors Knee extensors	3	3	5	5

[Table/Fig-6]: Comparison of Preintervention and postintervention values of Range Of Motion (ROM) and Manual Muscle Testing (MMT) for the right and left lower limbs.

VAS, which demonstrated a change from a preintervention score of 8/10 to a postintervention score of 2/10. Functional improvement was evaluated using the ODI [1], which showed a reduction in disability from 66% pretreatment to 42% post-treatment, indicating a meaningful improvement in functional status. Muscle strength was assessed using the MRC Scale [2], ROM was measured using goniometry for the lumbar spine, hips and knees [Table/Fig-6]. Bilateral improvements in ROM observed in the present case may be explained by the systemic and global effects of the intervention, which focused on enhancing overall flexibility, neuromuscular control and functional movement patterns. While clinical presentation may vary in laterality, the rehabilitation approach was not side-specific, thereby resulting in generalised improvements. These changes are clinically meaningful as they reflect improved functional mobility and reduced mechanical restriction during activities of daily living. Overall, the intervention led to measurable improvements in pain, strength, ROM and functional independence [3,4].

While intervention and through follow-ups symptoms were improving and assessed by outcome measures.

Also, tremor was reported as a presenting symptom, the patient's primary complaints were pain and muscle weakness. Tremor was intermittent and rarely observed during clinical assessment; therefore, it was not quantified and was documented qualitatively.

The present case does not suggest that the thickened filum terminale improved structurally with conservative treatment. Rather, the observed clinical improvement is likely due to functional and neurophysiological adaptations. The intervention may have reduced secondary musculoskeletal stress, improved neuromuscular control, enhanced flexibility and modulated pain pathways, thereby improving symptoms and functional capacity. These findings indicate that meaningful clinical improvement can be achieved despite persistence of the underlying structural tethering.

Follow-up imaging was not performed in the present case, as the primary focus of management was on clinical and functional outcomes rather than structural modification.

In the present study, the primary objective was to assess short-term functional and symptomatic outcomes following a structured conservative intervention. Therefore, a 3-month follow-up was included to evaluate the immediate sustainability of clinical improvements. Long-term follow-up was beyond the scope of this case report; however, we acknowledge this as a limitation and recommend that future studies include extended follow-up periods to assess long-term outcomes and disease progression.

DISCUSSION

The TCS is a progressive neurological condition characterised by traction on the spinal cord due to its abnormal fixation, resulting in pain, motor deficits and autonomic dysfunction. The present case report illustrates the effectiveness of a conservative integrative treatment strategy combining physiotherapy and Ayurveda intervention where it is based on *vatavyadhi chikitsa* in managing adult TCS [5,6]. Neurosurgical consultation was obtained at the time of diagnosis and surgical intervention was recommended. However, the patient opted for conservative management. During the course of treatment and follow-up, the patient was clinically monitored and re-evaluation for surgical consideration was advised if neurological deterioration occurred; however, the patient remained clinically stable throughout the follow-up period. The baseline findings, including a pain score of 8/10 and an ODI score of 66%, indicate moderate functional disability despite relatively high pain intensity. This suggests that functional limitations were consistent with pain levels, which is commonly observed in neurological conditions such as TCS. The early stage of presentation may have contributed to better responsiveness to conservative management. Although progressive exercise programs are a standard component of physiotherapy management, the novelty of the present case lies in the integrative approach combining structured physiotherapy with Ayurveda-based interventions in the management of adult TCS. Additionally, the present case report focuses on conservative management in a condition where surgical intervention is typically recommended, thereby providing insight into a non surgical rehabilitation strategy. The protocol was individualised and progressively structured based on functional status, emphasising neuromuscular control and symptom-specific rehabilitation. Despite the persistence of structural abnormalities such as a thickened filum terminale, the reduction in pain observed in the present case can be attributed to functional and neurophysiological adaptations rather than structural reversal. Physiotherapy interventions likely reduced mechanical stress on neural and musculoskeletal structures, improved motor control and enhanced neuromuscular efficiency. In addition, electrotherapy modalities such as interferential current may have modulated pain through gate control and endogenous opioid mechanisms [7]. These changes, along with the potential neuromodulatory and anti-inflammatory effects of adjunct Ayurvedic interventions, may explain the symptomatic improvement despite the unchanged anatomical pathology. Conservative management in TCS does not reverse the underlying structural abnormality, such as a thickened filum terminale. The improvements observed in the present case are likely attributable to functional and neurophysiological adaptations, including improved neuromuscular control, reduced secondary mechanical stress and modulation of nociceptive pathways. These mechanisms may lead to symptomatic and functional improvement despite persistence of the anatomical tethering. Ayurvedic interventions may be understood in terms of modern mechanisms such as reduction of inflammation, improvement in local circulation, modulation of neuromuscular function and regulation of pain pathways. These effects do not directly alter structural abnormalities such as spinal cord tethering but may contribute to symptomatic relief and functional improvement. Thus, the integration in the present case is based on complementary functional outcomes rather than direct equivalence of disease models.

Although TCS is typically progressive, the observed improvements are likely attributable to the intervention, as measurable changes were noted within a defined treatment period following initiation of therapy [7]. The structured and progressive rehabilitation program targeting neuromuscular control and functional capacity may

have contributed to these improvements beyond the expected natural course of the condition. However, the possibility of partial disease stabilisation cannot be entirely excluded. It is also possible that improvements may have been influenced by factors such as reduced anxiety, improved activity tolerance and increased patient engagement during rehabilitation. Additionally, spontaneous stabilisation of symptoms cannot be completely ruled out. Nevertheless, the structured intervention and consistent improvements across multiple outcome measures suggest a probable therapeutic effect.

Previous research has demonstrated that physiotherapy and Ayurveda therapies are designed specifically for persons who are unable to tolerate the rigors of surgery, some postsurgical cases, rehabilitative conditions, spasticity and paralytic conditions [8,9].

Previous studies have emphasised the therapeutic value of *Erandamooladi Niruha Basti* and *Abhyanga* in managing musculoskeletal and neuromuscular disorders, especially those linked to *Vata* imbalance in the lower back. Erandamooladi *Basti*, acts as a *Vata* pacifier and mild purgative, making it effective for stiffness, numbness and pain [10,11].

Pain reduction was achieved through IFT, which modulated nociceptive signals via gate control and opioid mechanisms, while improving circulation and cellular exchange [12]. In current case report, IFT was administered for 10 minutes per session, in accordance with existing literature indicating that effective treatment durations range between 10 and 30 minutes. Previous studies have demonstrated that even shorter durations (10-15 minutes) are sufficient to achieve analgesic effects in musculoskeletal conditions. Hence, a 10-minute application was considered appropriate to deliver effective pain modulation while maintaining patient comfort and treatment efficiency [12]. Ayurvedic interventions like *Erandamooladi Niruha Basti* and *Sahacharadi Anuvasana Basti* enhanced systemic absorption of anti-inflammatory and neuroprotective compounds. Additionally, internal medicines such as *Erandamoola Kwatha*, *Trayodashanga Guggulu* supported *Vata* pacification, nerve regeneration and improved metabolism.

Muscle strength, evaluated using the MRC Scale, improved by 1-2 grades, was achieved through a graded strengthening exercises protocol which enhanced motor unit recruitment and reversed disuse atrophy, while Ayurvedic interventions such as *Kati basti* may contribute to clinical improvement through localised thermal and therapeutic effects, leading to increased blood flow, reduction in muscle spasm and improved soft tissue extensibility. These mechanisms may indirectly modulate neuromuscular function and pain perception in the lumbosacral region, although direct neurophysiological effects on specific neural structures require further scientific validation [11].

The ROM measurements demonstrated notable gains, particularly in lumbar flexion, hip mobility and knee extension which resulted from stretching exercises which were aimed at improving muscle flexibility, reducing myofascial tightness and enhancing joint mobility rather than directly influencing spinal cord tension. These interventions may help reduce secondary mechanical stress on surrounding musculoskeletal structures and improve functional movement patterns without directly altering the underlying neural traction.

The use of *Sarvanga Abhyanga* and *Bashpa Sweda* helped reduce connective tissue adhesions, contributing to improved mobility and gains improvement in ROM.

Functionally, the patient's ODI improved from 66% to 42% [13]. This reflects the reduced pain, increased strength and improved ROM on the patient's ability to perform ADLs. The Ayurvedic interventions employed in the present study, including *Kati basti*, *Abhyanga* and *Basti*, are integral components of *Panchakarma* therapy and were applied as part of a comprehensive treatment approach. Their therapeutic effects are considered collectively rather than in isolation. Traditional Ayurvedic concepts such as "clearing channel obstruction" and "nourishing tissues" can be correlated with physiological processes including improved microcirculation, reduction of inflammatory mediators and enhanced tissue metabolism. Experimental and review-based evidence suggests that Ayurvedic herbs exhibit anti-inflammatory, antioxidant and neuroprotective effects, including suppression of proinflammatory cytokines and modulation of neural pathways. These mechanisms may explain the observed clinical improvements; however, further scientific validation is warranted [13,14]. Additionally, the patient demonstrated adherence and tolerance to all components of the intervention and remained clinically stable with no recurrence of symptoms during the 3-month follow-up period.

Although TCS is associated with a risk of long-term progression or recurrence, the patient remained clinically stable with sustained improvements during the 3-month follow-up period. This suggests that the conservative integrative intervention was effective in achieving short-term symptom control and functional improvement. While longer follow-up is required to evaluate long-term outcomes, the present findings highlight the potential role of conservative management in maintaining clinical stability in selected cases. As both interventions were administered concurrently, it was not possible to attribute causation to either physiotherapy or Ayurveda, nor determine which contributed more to the observed outcomes. This case supports the potential of integrative conservative management for adult TCS patients who decline surgery, with physiotherapy addressing neuromuscular issues and Ayurveda aiding systemic balance and neural healing.

Follow-up imaging was not performed postintervention, as the primary focus of management was on clinical and functional outcomes rather than structural changes. In conservative management of TCS, symptomatic and functional improvements are often considered clinically relevant even in the absence of radiological changes. However, future studies incorporating repeat imaging would be valuable to correlate structural and functional outcomes, also, future research should focus on controlled studies with long-term follow-up to better evaluate the effectiveness of integrative approaches in TCS and help to develop comprehensive treatment strategies for conditions like TCS.

CONCLUSION(S)

The present case of adult-onset TCS was managed conservatively over four weeks using an integrative approach combining physiotherapy and Ayurveda, following the patient's decision to decline surgery and showed notable improvements in symptoms with no adverse effects during treatment and follow-up.

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