REHABILITATION APPROACH FOR ZONE III FLEXOR TENDON REPAIR: A CASE STUDY

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ABSTRACT

This study focused on evaluating the effectiveness of post-surgical rehabilitation in a 6-year-old girl with a zone III flexor tendon injury in her dominant hand. The primary objective was to assess the functional outcomes and pain levels using the Total Active Motion (TAM) score and Visual Analogue Scale (VAS), respectively. The rehabilitation program consisted of various phases targeting pain management, early mobilization, and prevention of complications. The initial evaluation revealed limited range of motion and high levels of pain. However, over the course of the rehabilitation period, significant improvements were observed in both the TAM scores, indicating enhanced range of motion, and the VAS scores, indicating reduced pain levels. These findings underscore the effectiveness of a structured and progressive rehabilitation approach in restoring hand function and reducing pain in paediatric patients with zone III flexor tendon injuries.

Keywords: flexor tendon injury, zone III, Total Active Motion score, Visual Analogue Scale, range of motion, pain.

INTRODUCTION:

Hand plays an important role in human life in daily tasks and activities. Our hand is capable of performing complex functions like gripping, grasping, and many other precise movements. The functions of the hand and its coordination largely depends on the tendons acting upon the articulated skeletal elements [1,2]. An intact flexor tendon system is needed to perform complex finger functions and to manipulate the objects. In case if the flexor tendons get injured or there is any laceration, the flexor tendon is repaired surgically [2]. The flexor tendon injuries are divided into 5 anatomical zones i.e., zone I, zone II, zone III, zone IV and zone V. These injuries can lead to various types of complications like stiffness, oedema, scarring or adhesions [3]. The complications can further lead to reduced joint range of motion (ROM) and when ROM gets restricted, various daily tasks performed by the hand get affected significantly. After tendon repair surgery, the prolonged static splinting leads to adhesions and decreased strength of the tendon [4,5]. So, the physiotherapy treatment should aim at diminishing the adhesions and preventing the risk and complications like ruptures.

CASE REPORT:

This case report presents the rehabilitation progress of a 6-year-old school girl who sustained a zone III flexor tendon injury in her dominant hand. The injury resulted in a complete disruption of the Flexor Digitorum Superficialis (FDS) and Flexor Digitorum Profundus (FDP) tendons of the index, middle, and ring fingers. The injury occurred when a sharp object fell on her hand, resulting in an open wound on her palm. Immediate medical attention was sought, and the patient underwent surgical repair of the injured tendons and nerves. Following the surgery, a comprehensive rehabilitation program was initiated.

To monitor the progress of rehabilitation, two outcome measures were used: the Total Active Motion (TAM) score and the Visual Analogue Scale (VAS) for pain assessment. The TAM

score measured the active range of motion at the MCP, PIP, and DIP joints, while the VAS score evaluated the level of pain experienced by the patient.

During the initial evaluation, the patient exhibited limited range of motion and significant pain. However, over the course of the rehabilitation period, notable improvements were observed. By day 14, there was an increase in TAM scores, indicating improved range of motion, and a decrease in VAS scores, suggesting a reduction in pain levels. These improvements continued at week 4, with further enhancements in both TAM scores and VAS scores.

At the 3-month mark, the patient demonstrated near-normal range of motion at the MCP, PIP, and DIP joints based on the TAM scores. The TAM scores indicated a range of motion of 90-100 degrees at the MCP joints, 80-90 degrees at the PIP joints, and 70-80 degrees at the DIP joints. Additionally, the VAS score indicated minimal pain experienced by the patient, with a score of 0-1.

The significant improvements observed in both the TAM scores and VAS scores reflect the effectiveness of the rehabilitation program in restoring hand function and reducing pain levels for the 6-year-old girl with a zone III flexor tendon injury. These outcomes highlight the importance of a multidisciplinary approach involving proper surgical repair and comprehensive rehabilitation interventions in achieving favorable outcomes in hand rehabilitation.

Rehabilitation Protocol:

Phase 1: Day 1 to Day 14

During the initial phase of rehabilitation, the focus was on pain management, promoting early mobilization, and preventing complications. The following protocols were implemented:

Moist Hot Fermentation: The use of moist heat for 10 minutes aimed to reduce pain and promote tissue relaxation.

Gentle Passive Mobilization: Passive mobilization exercises were performed to gently move the injured finger joints, including the MCP, PIP, and DIP joints. This helped improve joint mobility and prevent stiffness.

Aerobic Mobilization of the Hand: Various activities were incorporated to promote overall hand movement and circulation. These activities included towel crawling, fist making, joining hands, making a spider web with hands, and squeezing a sponge or plush ball.

Peg Board Games: Engaging in peg board games helped improve dexterity and fine motor skills.

Home Program: The patient was advised to continue rehabilitation exercises at home, including making hand impressions and creating shapes with play dough. This encouraged active participation in the rehabilitation process.

Phase 2: Week 2 to Week 4

In this phase, the focus shifted towards further strengthening the injured hand and promoting functional recovery. The following protocols were added to the rehabilitation program:

Paraffin Wax Therapy: Paraffin wax therapy was used to provide deep heat therapy, enhance circulation, and promote joint mobility.

Tendon Gliding Exercises: Specific tendon gliding exercises were introduced to improve the gliding function of the flexor tendons. These exercises included straight hand, hook fist, full fist, table top, and straight fist movements.

Flexor Tendon Blocking Exercises: Isolated PIP and DIP flexion exercises for the middle and ring fingers were performed to improve finger flexion strength and control.

Self-Resistance Exercises: The patient engaged in self-resistance exercises to strengthen the extrinsic finger flexor muscles, promoting better finger control and function.

Mirror Therapy: Mirror therapy was employed as a visual feedback technique to enhance motor relearning and promote neural reorganization.

Therapeutic Ultrasound Therapy (UST): UST was used to provide deep heating and promote tissue healing, reducing inflammation and pain.

Manual Scar Mobilization: Prolonged low-intensity stretching techniques were used to mobilize and soften scar tissue, improving tissue extensibility and preventing adhesions.

Home Program: The home program included activities such as using play dough, engaging in grasping activities, and performing self-stretching exercises for the lumbricals and extrinsic flexor muscles.

Phase 3: Week 4 to Month 3

During this phase, the rehabilitation program continued with the same treatment modalities as in Phase 2, with a few modifications:

Lumbrical Stretching: Specific stretching exercises targeting the lumbrical muscles were introduced to improve finger joint flexibility and range of motion.

Strengthening Exercises with Thera Tube: Thera tube exercises were incorporated to further strengthen the hand muscles and enhance grip strength.

Phase 4: Month 3 and Beyond

During this phase, the focus shifted towards fine-tuning the patient's hand function and further improving their overall functional abilities. The following interventions were incorporated into the rehabilitation program:

Functional Activities and Task-Specific Training: The patient engaged in various functional activities that mimicked their daily tasks and hobbies. These activities were designed to improve hand-eye coordination, precision, and endurance. Examples include writing exercises, using utensils, playing musical instruments, and engaging in sports or recreational activities.

Home Exercise Program: The patient was encouraged to maintain an active home exercise program to sustain the gains achieved during rehabilitation. They were provided with a personalized home exercise routine that included a combination of stretching, strengthening, and functional activities.

Follow-up Assessments: Regular follow-up assessments were scheduled to monitor the patient's progress, address any new concerns, and make further adjustments to the rehabilitation program if necessary. These assessments helped ensure the maintenance of optimal hand function and addressed any residual limitations.

DISCUSSION:

Our study presented a case of post-surgical rehabilitation for a zone III flexor tendon injury in a 6-year-old girl's dominant hand. The implementation of a comprehensive rehabilitation program, guided by the Total Active Motion (TAM) score and Visual Analogue Scale (VAS) for functional and pain assessment, yielded significant improvements in range of motion and pain levels over time. These findings emphasize the importance of a well-structured and progressive rehabilitation approach in achieving favourable outcomes following flexor tendon repair surgery. By integrating proper surgical techniques with targeted rehabilitation interventions, clinicians can effectively restore hand function and alleviate pain in patients with zone III flexor tendon injuries. Further research and studies are warranted to enhance our understanding and optimize the rehabilitation protocols for such injuries.

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