CASE REPORT

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Physical therapy management for muscle tightness in a surfing athlete: a case report study

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ABSTRACT

Background: Muscle tightness refers to the sensation of tension or stiffness in the muscles, often resulting from factors such as excessive physical activity, inadequate warm-up before exercise, muscle injury, or underlying medical conditions. This article describes a case of a surfer patient with muscle tightness who has had ACL reconstruction meniscectomy and physical therapy management.

Case description: The patient was a 51-year-old male surfing athlete from New Zealand diagnosed with muscle tightness. The patient had a history of ACL and meniscus injuries, followed by ACL reconstruction and meniscectomy of the right knee. The patient was on vacation in Bali, and he was surfing every day. The patient underwent physical therapy twice a week. The intervention program included modalities (transcutaneous electrical nerve stimulation and ultrasound), manual therapy (massage and patellar mobilization), and exercise therapy (range of motion exercises, strength training, and stretching).

Conclusion: The physical therapy intervention program designed for one week can yield positive results in reducing pain levels, improving the range of motion of the right knee, increasing the circumference of the right knee segment, and enhancing the functional activities of the right knee.

Keywords: Physical therapy management, surfing, tightness muscle, tourist injuries.
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INTRODUCTION

The global improvement in health conditions following the COVID-19 pandemic has brought Bali into the spotlight for tourists. Tourism levels are gradually recovering with the arrival of both international and domestic visitors. The government and investors are beginning to revitalize and introduce innovations to restore Bali's tourism sector. Enhancing the quality of healthcare services has become a primary concern, given the potential injuries that tourists might experience. Academics and healthcare professionals collaborate in their respective fields, covering everything from prevention, health promotion, and treatment to rehabilitation. Observing potential hazards in tourist areas is crucial to prevent injuries during all tourism phases before, during, and after engaging in tourist activities.

Bali, renowned for its beaches and waves, attracts many tourists. According to the Central Statistics Agency of Bali Province 2022, the number of international tourists visiting Bali in December 2022 was 377,276, representing an increase of 31.27% compared to the previous month.[1] The rising number of tourist visits also correlates with an increase in the incidence of accidents. Engaging in activities at the beach carries a higher risk of accidents than land activities.[2,3] Previous research reported 16 cases of sea swimmers experiencing spinal injuries when overturned by ocean waves, with all injuries located in the sub-axial cervical spine. Hyperextension was the most common injury mechanism, accounting for 75% of cases.[4]

Surfing is a water sport involving riding on a board atop ocean waves. This activity is highly favoured by international tourists, especially during the winter season in their home countries. The sport comprises several stages, including paddling, resting, wave riding, breath holding, and maintaining balance on the surfboard in the waves. All these stages require significant muscle strength.[5] Muscles with increased torso rigidity more effectively transfer force, resulting in more incredible limb speed.[6]

According to Andrew Nathanson et al., who conducted a study with 1,348 participants, there were 1,237 acute injuries and 477 chronic wounds. Of the acute injuries, 42% were abrasions, 13% were contusions, 12% were sprains/strains, and 8% were fractures. Acute injuries were distributed, with 37% in the lower extremities and 37% in the head and neck. Meanwhile, 55% of all injuries resulted from contact with the surfboard itself, 12% from contact with another surfer's board, and 17% from contact with the ocean itself.[7]

Overuse injuries are influenced by repetitive movements that result in microtrauma to muscles, tendons, bones, or bursae. This generates pain during movement and can affect joints in the body. Some cases of tendinopathy, physical injuries, and stress reactions result from a

"failed healing response," where the natural inflammatory response and healing process are disrupted.[8,9] Recreational and professional surfers can spend up to 4 hours in the water during a single session.[10] Paddling in a prone position for an extended period with isometric cervical hyperextension and repetitive movements through manoeuvres can lead to overuse injuries in surfing.[11] Imbalances in muscle contractions and a lack of flexibility in the shoulder, abdomen, back, and hip regions can be risk factors for surfers' injuries. In cases of overuse, there is an increase in muscle tension from both active and passive stabilization mechanisms. Passively, muscles may shorten due to postural adaptations or the presence of scar tissue, while actively, muscles may shorten due to spasms or repeated contractions, referred to as muscle tightness.[12,13] Due to the injuries experienced by the patient, an improvement in the safety and security of tourism is necessary. Additionally, education regarding the risks associated with water sports activities is paramount. This research aims to determine the effectiveness of the intervention program provided to the patients so that they can enjoy their vacation time in Bali.

CASE DESCRIPTION

A 51 years old, surfing athlete, male patient, complained of a dull ache in the medial and lateral patella. The patient also reported tightness in the lateral hip extending towards the patella, which had started two weeks prior after changing surfing equipment. The pain improved when the patient performed abductor muscle stretching and acupuncture therapy in the painful area, but the pain persisted.

Previously, the patient had been a surfing athlete who had experienced an ACL and meniscus injury in 1998 during a snowboarding photoshoot. The injury had occurred due to falling beyond the target point and involving overextension of the right knee. Following this, the patient had undergone a two-year strengthening program, with no surfing exercises in the first year and surfing exercises in the second year. Subsequently, an ACL reconstruction and meniscectomy had been performed on the right knee in the year 2000.

At the time, the patient had been vacationing in Bali and actively participated in surfing at Nelayan Beach for eight consecutive months without a break. Two weeks ago, the patient's knee had suddenly swollen and become painful. A similar incident occurred approximately two years ago due to overuse in surfing.

ASSESSMENTS

Several measurements were taken on the patient, including pain scale measurements on both legs using the NPRS (numeric pain rating scale), range of motion (ROM) of the right and left knee joints using a goniometer, segment circumference measurements at 20 cm superior mid patella, 10 cm superior mid patella, 5 cm superior mid patella, mid patella, 10 cm inferior mid patella, and 20 cm inferior mid patella using a midline, the patient's daily functional activities using the Barthel Index, and knee functional assessment using the Lysholm Knee Scoring.[14]

Pain measurement using NPRS with a scale of 0 – 10 was conducted. The patient was instructed to encircle the number representing the level of pain they felt. Zero represented no pain, and ten represented the most intense pain ever experienced.

ROM measurements on the right and left knees were conducted using a goniometer. During knee joint ROM measurement, with the patient conscious, the patient's bed was first straightened. The physiotherapist placed the goniometer on the knee, where the goniometer's axis was positioned at the lateral epicondyle of the femur, the stationary arm was placed at the greater trochanter of the femur, and the moving arm was placed parallel to the lateral malleolus. Subsequently, the patient was asked to move their right knee towards knee flexion as much as possible. While the patient moved their right knee, the physiotherapist also moved the moving arm of the goniometer following the knee's motion. In contrast, the stationary component of the goniometer remained stationary and parallel to the greater trochanter of the femur. The physiotherapist then measured and recorded the degrees from the patient's active knee movement.

Measurement of the circumference of the right and left lower extremities segments was performed using a midline at 20 cm superior mid patella, 10 cm superior mid patella, 5 cm superior mid patella, mid patella, 10 cm inferior mid patella, and 20 cm inferior mid patella. The measurement began by measuring the mid patella's length and identifying the mid patella's midpoint. Subsequently, the physiotherapist measured according to the segment circumference measurement to be conducted. Segment circumference measurements were taken on both legs to observe any differences in the segment circumference of the two legs.

The patient's daily functional activities were measured using the Barthel Index. The physiotherapist asked about the patient's ability to control bowel movements, urination, self-care, toileting, eating, mobilization, transfers, dressing, stair climbing, and bathing. Then, the physiotherapist assessed the patient's abilities in numerical form and interpreted them.

Finally, knee function was measured using the Lysholm Knee Scoring. The patient was asked to fill out a knee functional questionnaire regarding walking impairment, the use of walking aids, the sensation of "locking" during activities, instability during activities, pain during activities, swelling of the knee during activities, stair climbing, and the patient's squatting ability. Then, the physiotherapist assessed the patient's abilities in numerical form and interpreted the patient's functional skills in the knee. The interpretation of Lysholm scores is divided into the categories of Excellent (95–100), Good (84–94), Fair (65–83), and Poor (<64).

INTERVENTIONS

Physical therapy management was carried out by designing a physical therapist exercise program tailored to the issues faced by the patient. This exercise program is designed to be implemented over one week, after which its progress will be assessed. Therefore, this exercise program aims to reduce pain levels, improve the range of motion in the right knee joint, increase the circumference of the right lower limb segment, and enhance the functional activities of the right knee.

Table 1. Physical therapy interventions protocol for a patient with ACL reconstruction and menisectomy

Indication	Target	Physical therapy intervention	Patient's position	Procedure	Dosage	Day
Knee oedema	Knee	Ultrasound	Lying on the back	Ask the patient to lie relaxed, and the therapist applies gel to the target area. Next, the therapist will use an ultrasound probe over the gel on the target area.	Frequency: 1 MHz Intensity: 0,8 Ratio: 1:1 Time: 8 minutes	1
Pain	Knee	TENS	Lying on the back	Ask the patient to lie down in a relaxed position, place a pad on the painful area, and determine the desired dosage.	Pulse ratio: 10 Pulse frequency: 300 Intensity: 35 Hz	1
Tightness muscle	Quadricep, Abductor hip, Hamstring, and calf muscle	Massage	Lying on the back	Ask the patient to lie down in a relaxed position, and the therapist performs a massage using effleurage, friction, petrissage, tapotement, and vibration techniques.	15 minutes	1
		Stretching	Lying on the back	Instruct the patient to lie prone, then provide passive movements and stretches to the quadriceps, hamstrings, hip abductors, and calves.	Eight repetitions hold for 10 seconds	1-7
Decreased ROM	Knee dextra	Patellar mobilization	Lying on the back	Ask the patient to lie down in a relaxed position. Then, the therapist mobilizes the patient's kneecap in all directions.	50 times	1
		Heel slide	Lying on the back	The patient is lying down on the bed with the affected leg semi-flexed. Then, ask the patient to perform sliding movements with the injured leg to increase the range of motion in the joint.	Ten times	1-7
		Sitting cross-legged exercise	Sitting cross-legged	The patient is instructed to sit cross-legged and maintain the position while holding the stretch to maximize the range of motion (ROM).	5 minutes	1-7
Reduction in segment circumference	Quadricep, Abductor hip, Hamstring, Calf muscle	Double and single calf raise	Stand up	The patient is positioned standing at the edge of a deck and then instructed to perform a calf raise with both legs followed by a single-leg calf raise.	Ten times Three sets	1-7
		Squat static	Stand up	The patient is instructed to perform squatting movements in place using a resistance band attached to both upper thighs.	Work: 10, cycle 10, rest: 6 Set: 3	1-7
		Step up-down box	Stand up	The patient is asked to step onto a 40 cm high box while gripping two dumbbells weighing 4 kg each. Then, the patient ascends and descends from the pack with feet parallel, knees aligned forward, gaze straight ahead, and maintaining an upright posture without bending the torso.	Twelve repetitions, three sets, With a weight of 4 kg.	1-7
		Single romanian deadlift	Stand up	The patient is instructed to stand and hold a 2 kg weight in each hand. Then, lift one leg with the knee bent, and the patient is asked to swing the bent leg backwards until the knee is straight. Simultaneously, the patient also lifts the given weights.	Twelve repetitions, three sets, with a weight of 4 kg.	1-7

ROM, range of motion; TENS, transcutaneous electrical nerve stimulation

Table 2. Physical therapy measurements at 1st meeting

Measurement	Tool	Results
Pain	NPRS	Pain during movement: 4/10 knee flexion, flexion, and abduction hip Pain during rest: 3/10 sitting down Pressure pain: 6/10 flexor and abductor's hip and around the patella
ROM	Goniometer	Knee dextra S: 0° - 0° - 130° Knee sinistra S: 0° - 0° - 150°
Segment circumference	Midline	

Regio	Dextra	Sinistra	Difference
20 cm superior mid patella	49.2 cm	51.7 cm	2.5 cm
10 cm superior mid patella	40.5 cm	43 cm	2.5 cm
5 cm superior mid patella	39.2 cm	39.8 cm	0.6 cm
Midpatella	39.2 cm	38.5 cm	0.7 cm
10 cm inferior mid patella	32.4 cm	33.4 cm	1 cm
20 cm inferior mid patella	31 cm	32.3 cm	1.3 cm

Functional activity — Barthel Index

Activity	Score
Bowel control	10
Urinary control	10
Self-care	5
Toileting	10
Eating	10
Mobilization	15
Transfer	15
Dressing	10
Stair climbing and descending	10
Take a bath	5
TOTAL	100 –Independent

Knee functional	Lysholm Knee Scoring	Score: 74% Fair

NPRS, numeric pain rating scale; ROM, range of motion

The physical therapy modalities provided include ultrasound for 10 minutes, TENS for 15 minutes, massage for 15 minutes, and stretching (8 reps). Besides that, exercises are given in the form of patellar mobilization (50 reps), heel slide (10 reps), sitting cross-legged exercise (5 minutes), double and single calf raise (3 sets and ten reps), static squats (3 sets and ten reps), step up-down box (3 sets and 12 reps), and single Romanian deadlift (3 sets and 12 reps). All exercises were performed according to the protocol procedure described in Table 1.

EVALUATION

Evaluation was done after the intervention (Table 2 and Table 3). Evaluation results include pain, ROM, functional activities with Barthel Index instruments, and functional knees with Lysholm instruments. Pain measurement using NPRS (Numeric Pain Rating Scale) shows a decrease in the degree of pain during movement and pain during rest pressure pain. Pain during movement decreased from 4 to 2, pressure pain from degree 6 to 2, and pain during rest from degree 3 to 1. ROM measurements were evaluated to obtain maximum left knee ROM. In dextra active ROM, there is a difference from the first evaluation to the last assessment, namely from 130° to 140°. The results of the functional activity evaluation using the Barthel Index were the same as those of the pre-intervention. In the measurement of segment circumference, there was an increase in segment circumference "20 cm above the patella" by 0.8 cm, "10 cm above the patella" there was a change of 1.0 cm, "5 cm above the patella" by 0.6 cm, midpatella by 0.3 cm, "10 cm below the patella" by 0.4 cm, and "20 cm below the patella" by 0.4 cm. Finally, there was an improvement in the functional measurement of the knee using Lysholm.

DISCUSSION

In this case report, the patient demonstrated progress in recovering their condition. The exercise program designed and implemented for the patient over one week has reduced pain levels, improved the range of motion in the joints, increased the circumference of the segments, and enhanced the functional activities of the patient's knee. The results of this intervention can be seen in Table 2 and Table 3.

Initially, the patient was afraid to move and put weight on the right leg due to the pain experienced. Additionally, the patient had been inactive for two weeks due to this pain, resulting in atrophy in the muscles of the right lower limb. The pain and oedema led to limitations in the range of motion in the joint and a decrease in functional activities of the right knee. After one week of the exercise program, the pain decreased, the range of motion in the

Table 3. Evaluation I Results, 2nd meeting

Measurements	Measurement tool	Result
Pain	NPRS	Pain during movement: 2/10 flexion the knee, flexion, and abduction of the hip Pain during rest: 1/10 sitting down Pressure pain 2/10 flexor dan abductor hip, and around the patella
ROM	Goniometer	Knee dextra S: 0° - 0° - 140° Knee sinistra S: 0° - 0° - 150°
Segment circumference	Midline	See nested table below
Functional activity	Barthel Index	See nested table below
Knee functional	Lysholm Knee Scoring	Score: 94% Good

Regio	Dextra	Sinistra	Difference
20 cm superior mid patella	50 cm	51.7 cm	1.7 cm
10 cm superior mid patella	41.5 cm	43 cm	1.5 cm
5 cm superior mid patella	39.8 cm	39.8 cm	0
Midpatella	39.5 cm	38.5 cm	1 cm
10 cm inferior mid patella	32.8 cm	33.4 cm	0.6 cm
20 cm inferior mid patella	31.4 cm	32.3 cm	0.9 cm

Activity	Score
Bowel control	10
Urinary control	10
Self-care	5
Toileting	10
Eating	10
Mobilization	15
Transfer	15
Dressing	10
Stair climbing and descending	10
Take a bath	5
TOTAL	100 - Independent

NPRS, numeric pain rating scale; ROM, range of motion

Figure 1. Physical therapy interventions for anterior cruciate ligament reconstruction and meniscectomy.

right knee joint increased, the right lower limb segment's circumference increased, and the right knee's functional activities improved.

The physiotherapist administered ultrasound therapy to address the knee oedema.[14] This therapy can expedite the healing and repair of soft tissues by stimulating the release of histamine, which cleans debris from the injury area, and by stimulating fibroblasts and endothelial cells to form tissue rich in collagen. This therapy can form new connective tissue crucial for soft tissue repair with good vascularization.[15]

The patient was given electrical stimulation through TENS (transcutaneous electrical nerve stimulation) to alleviate the perceived pain. The use of TENS is associated with a descending mechanism of pain control that stimulates Aδ and C fibres, causing the release of endogenous opioids (β-endorphins). This inhibits the depolarization of postsynaptic nerves, thereby inhibiting the transmission of pain impulses to the thalamus.[16]

Massage and stretching are performed to reduce the tightness of muscles in the patient. Massage is one of the most widely used recovery strategies and has evidence of reducing DOMS (delayed onset muscle soreness), muscle stiffness, and immune compounds that can affect muscle fatigue. While more than a single massage session may be required for recovery, some studies also indicate that repeated massage is not superior to a single application.[16,17] Other research suggests that increased ROM

after static stretching is associated with a decrease in passive muscle stiffness and changes in muscle stretch tolerance.[18,19]

Active range of motion exercises allows movement throughout the targeted structures, including joint surfaces, muscles, capsules, fascia, blood vessels, and nerves.[20,21] A-AROM incorporates the active participation of the person executing the activity, in contrast to passive range of motion exercises, in which an external force pushes a joint through its complete range of motion. Active-aided ROM is usually used after an accident or surgery when there has been some healing and the muscles may contract. Still, protection is needed to prevent injuring the body part that is mending. Therefore, exercises like heel slides and sitting cross-legged are performed to increase the limited ROM of the right knee.

Strengthening exercises are known to have peripheral and central effects on pain. Peripherally, exercises can increase muscle strength, coordination, and proprioception to enhance joint control, thereby reducing nociceptive input from the affected knee.[22,23] Centrally, exercises can activate opioidergic pathways and endogenous pain control. Additionally, strengthening exercises can train body coordination and stability. Therefore, strengthening exercises such as double and single calf raises, static squats, step-up-down box exercises, and single RDLs are performed to reduce pain and increase muscle strength, coordination, proprioception, and body stability.[24] limitation of this study of a control group is that it is difficult to determine the effectiveness of physical therapy management in surfing athletes compared to other methods or interventions. A study with a control group would provide a more valid comparison.

CONCLUSION

This research demonstrates that the exercise program designed for one week can yield positive results, namely, reducing pain levels, improving the range of motion of the right knee, increasing the circumference of the right knee segment, and enhancing the functional activities of the right knee. Additionally, the patient can engage in surfing activities gradually. In the future, this case can serve as a reference for researchers encountering similar issues. Furthermore, stakeholders in the tourism industry and practitioners/ academics in tourism health are expected to improve the safety and security of tourists during recreational activities.

CONFLICT OF INTEREST

This research has no conflict of interest.

ETHICAL CONSIDERATION

The patient had permitted the authors to publish her case in a scholarly journal without disclosing any personal information for educational purposes.

FUNDING

No grant source funded this study.

AUTHOR CONTRIBUTION

GV, IPP, and PDA carried out the study, were in charge of the research plan, and compiled the findings. TFW, LIH, and IDGAK completed drafts of the manuscript and literature study.

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