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The Effectiveness of Electromyographic Biofeedback, Mirror Therapy, and Tactile Stimulation in Decreasing Chronic Residual Limb Pain and Phantom Limb Pain for a Patient with a Shoulder Disarticulation: A Case Report

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UNIVERSITY OF ST. AUGUSTINE

FOR HEALTH SCIENCES

THE EFFECTIVENESS OF ELECTROMYOGRAPHIC BIOFEEDBACK, MIRROR THERAPY, AND TACTILE STIMULATION IN DECREASING CHRONIC RESIDUAL LIMB PAIN AND PHANTOM LIMB PAIN FOR A PATIENT WITH A SHOULDER DISARTICULATION: A CASE REPORT

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PURPOSE

There are 1.3 million people in the United States living with limb loss, and most experience some form of residual limb pain or phantom limb pain (PLP). The purpose of this case study was to determine the effectiveness of mirror therapy, tactile stimulation and biofeedback in decreasing chronic residual limb pain and PLP in a patient with an upper limb traumatic amputation.

PATIENT DESCRIPTION

A 48-year-old male machinist who sustained a right shoulder disarticulation while working on a conveyor belt. The patient's limitations included difficulty with sleeping, household chores, yard work, and cooking. Participation limitations included decreased recreational activities with his 15-year-old son, limited personal interactions with his wife, and decreased confidence with general daily activities.

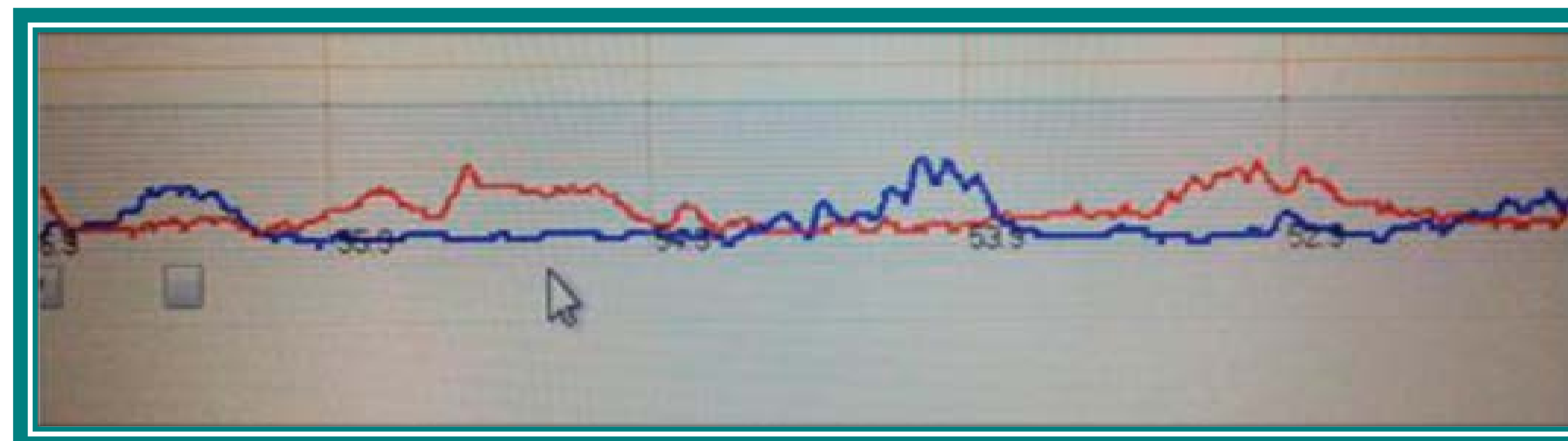


METHODS

Treatment included 8-weeks of physical therapy twice weekly prior to prosthetic fitting, followed by an additional 6-weeks for post-prosthesis rehabilitation. The interventions focused on pain relief, managing edema and phantom limb pain, and improving shoulder complex muscular control to promote return to function.

INTERVENTIONS

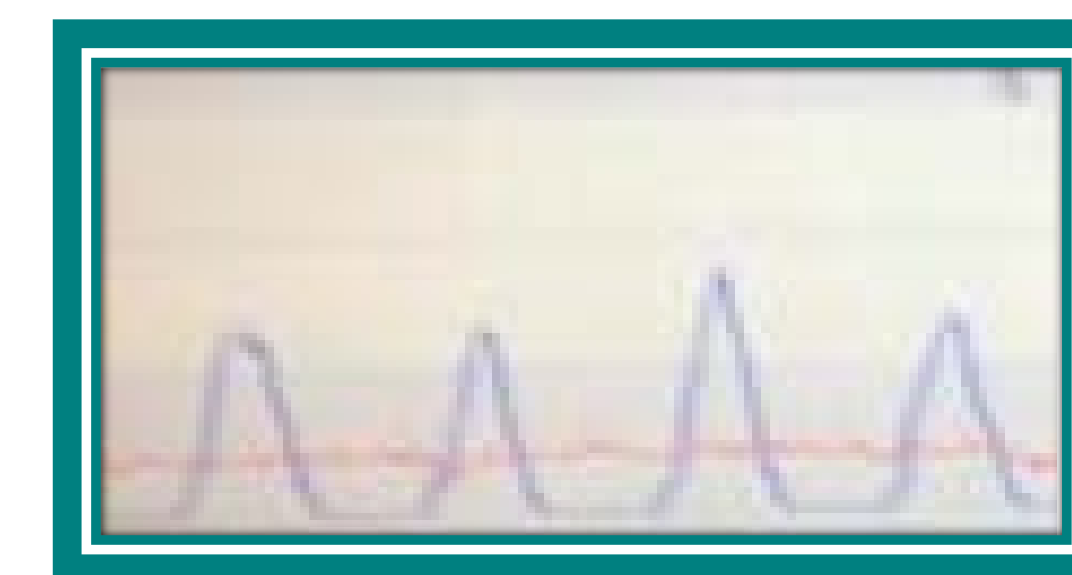
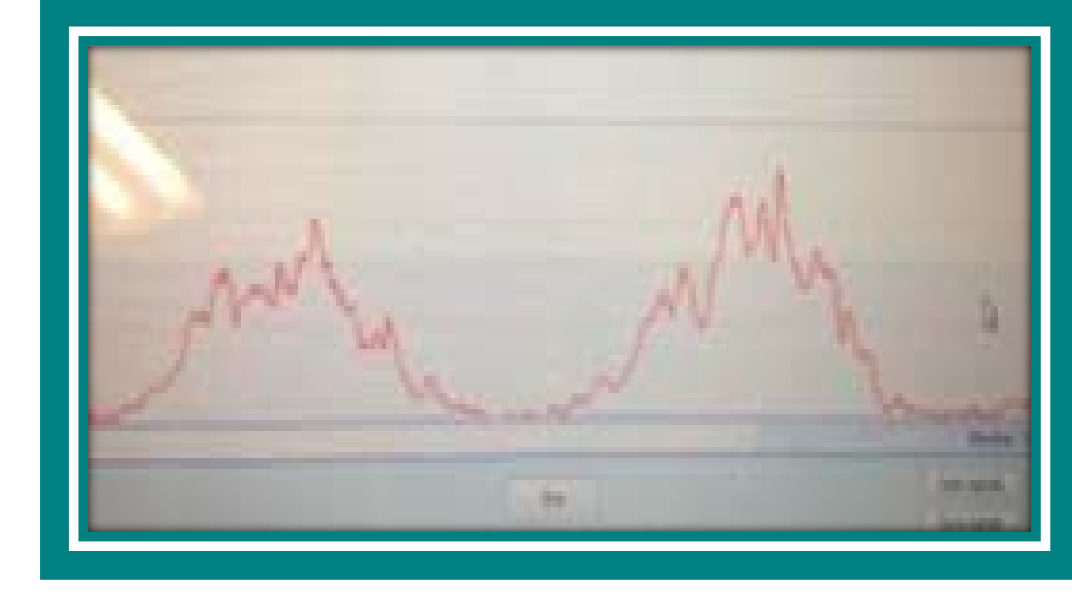
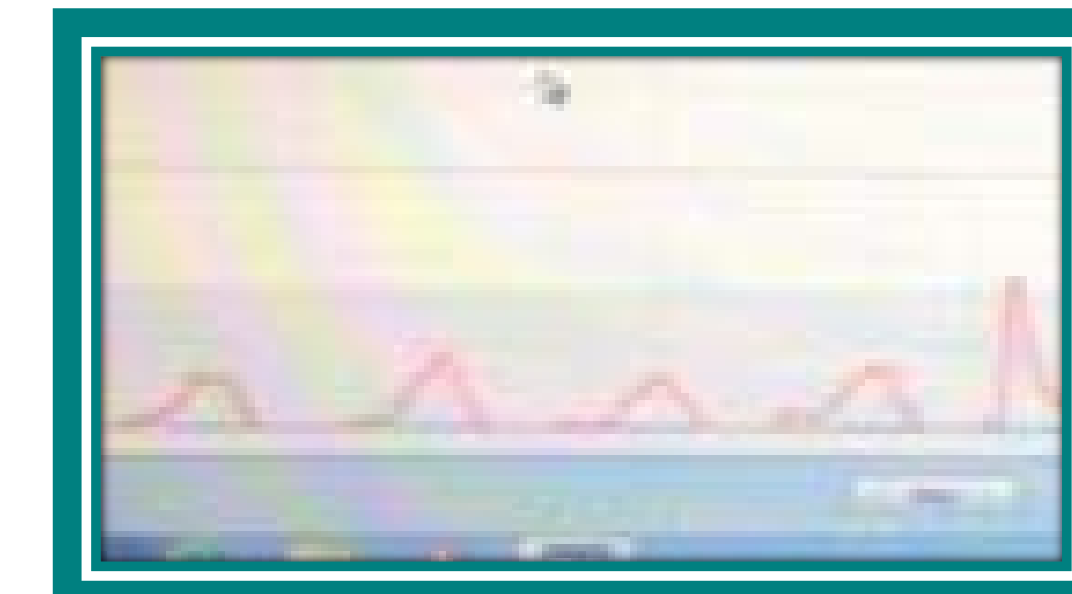
- Electromyography (EMG) biofeedback training to infraspinatus and pectoralis major muscle in short and quick, sustained, and gradual contractions with decreasing sensitivity of electrodes
- Mirror therapy with wrist flexion, extension, radial and ulnar deviation, pronation, supination, and shoulder flexion
- Scapular proprioceptive neuromuscular facilitation (PNF)
- High-voltage electrical stimulation
- Retrograde massage, scar and soft tissue mobilization
- Tactile cuing



Biofeedback Initial Evaluation: Gain Ratio Set at 7

RESULTS

- 30% decrease in Disability of the Arm, Shoulder, and Hand (DASH) score
- Decreased pain on Numeric Pain Rating Scale(NPRS) from 9/10 to 3/10
- Reached 60 mV above baseline with the lowest sensitivity electrode demonstrating improved muscular control
- Increased amplitude of contraction of infraspinatus and pectoral muscles demonstrating improved muscle control
- Decreased edema
- The patient reported increased confidence in social interactions with friends and personal interactions with his wife
- Able to participate in recreational activities with his teenage son



Biofeedback Eight Weeks: Gain Ratio at 4 Blue Pectoralis Major, Gain Ratio at 5 Red Infraspinatus

DISCUSSION

The patient demonstrated significant improvements in EMG biofeedback muscular control, DASH score, edema measurements, and PLP. The mirror therapy protocol in combination with tactile stimulation and biofeedback training, resulted in a significant decrease in disability rating and pain. The outcomes further strengthen previous evidence on the potential benefits of utilizing a combination of interventions when treating patients with the complex phenomenon of PLP. It is important to address muscular control through the use of biofeedback for pre-prosthetic training, improving the patient perception of movement, decreasing the patient's fear of movement, and enhancing the overall patient's perception of self-improvement.

CONCLUSION

The outcomes support the use of multiple interventions including EMG biofeedback, mirror therapy, and tactile stimulation when treating a patient with functional deficits, residual limb and phantom limb pain.

This case report was required for partial fulfillment for the Doctor of Physical Therapy degree (DPT) at the University of St. Augustine for Health Sciences.