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Effects of Percussion Therapy for Delayed Onset Muscle Soreness in Quadriceps Muscle in Young Footballers an Experimental Study

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Abstract

Background: 48-78% of football players experience soreness and pain of the quadriceps, especially players who play numerous games without proper recovery and rest. Quadriceps muscle is prone to overuse developing muscle tightness and hyperirritability of sensory nerves producing pain. Percussion therapy is the use of massage gun technology with rapid vibrations and percussions to the skin and underlying soft tissue.

Aim: To observe the effects of percussion therapy *vs.* stretching on soreness, pain and range of motion in individuals with quadriceps soreness.

Methodology: 60 participants were assigned to two groups. Group A received percussion therapy for 2 mins and group B received stretching for 10-15 seconds over the quadriceps muscle. NPRS, ELY'S and Likert scale for DOMS was assessed pre-treatment as well as post-treatment.

Results: A statistically significant difference was seen in soreness, pain and Likert scale for soreness ($p<0.001$) between the groups and percussion therapy provided a significantly higher improvement.

Conclusion: Percussion therapy is more beneficial as compared to stretching in individuals with quadriceps soreness. There was a significant reduction in quadriceps pain post-treatment by percussion therapy.

Keywords: Physiotherapy • DOMS • NPRS • Sports • Numerical pain rating scale • Percussion therapy • ELY • Likert scale for DOMS • Quadriceps

Introduction

Football, a dynamic team sport played by two teams of eleven players each, revolves around the objective of maneuvering a ball across the playing field using primarily footwork, aiming to outscore the opposing team by propelling the ball into their goal. Governed by the Laws of the Game, a set of regulations established since 1863 and continually updated by the International Football Association Board (IFAB) since 1886, football matches traditionally consist of two 45-minute halves, totaling a standard game time of 90 minutes. The game employs a spherical ball typically measuring 68–70 cm (27–28 in) in circumference. Apart from the excitement on the field, off-field considerations such as player fitness and recovery play crucial roles in maintaining performance levels. One common challenge athletes face is Delayed Onset of Muscle Soreness (DOMS), characterized by stiffness and soreness in muscles following intense physical exertion. DOMS typically peaks 24 to 72 hours' post-activity and can impair muscle function and strength, impacting subsequent training sessions or competitions [1]. To alleviate DOMS and enhance recovery, athletes and coaches employ various treatment modalities. These include traditional methods such as stretching, acupuncture, and heat therapy [2], as well as more contemporary techniques like foam rolling and Vibration Training (VT). VT, a burgeoning form of physical therapy, is gaining traction for its ability to promote neuromuscular excitability, enhance muscle control, and mitigate the incidence of DOMS [3]. A notable development in the realm of recovery

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modalities is Percussion Therapy (PT), which utilizes handheld massage devices to deliver rapid pulses of vibration to targeted muscle areas [4]. Drawing inspiration from tapotement massage therapy, PT stimulates vasodilation and cutaneous reflexes, thereby reducing muscle soreness and improving flexibility [5]. By offering adjustable settings for frequency, amplitude, and torque, PT devices cater to individual preferences and recovery needs, serving as valuable tools for both athletes and fitness enthusiasts alike. Recognizing the significance of effective recovery strategies in optimizing athletic performance, coaches and sports scientists advocate for the systematic application of recovery modalities. In soccer, where players often face demanding schedules and high workloads, implementing diverse recovery techniques such as massage, cold therapy, stretching, and foam rolling [6] becomes imperative. These strategies aim to mitigate fatigue, expedite recovery, and enhance sport-specific fitness, ensuring athletes maintain peak performance levels throughout the season. To reduce DOMS in football players, recuperation tools are needed. Utilizing efficient recovery techniques can considerably improve athletes' overall recovery and, as a result, their performance and reduce their chances of getting injured and help them exert to achieve new heights [7]. But these technologies must be proven effective through thorough research. Unfortunately, there isn't enough high-quality data available right now to compare the efficacy of various recovery techniques. Percussion or vibration treatment is a relatively recent technique that is worthwhile researching because it has demonstrated promise in other sports. To ascertain this method's potential as a recovery technique, high-quality studies on its advantages and efficacy in footballers are required. By filling in this knowledge gap, we may better comprehend how vibration or percussion therapy affects DOMS reduction and eventually assist footballers in their healing and helping them achieve their goals.

Materials and Methods

A comparative experimental study was designed to investigate the effectiveness of two different interventions in reducing Delayed Onset Muscle Soreness (DOMS) among recreational football players. The target population comprises individuals who regularly engage in football activities, with a sample population specifically focusing on those experiencing DOMS. The sampling method employed is non-probability, with purposive sampling utilized to select participants meeting specific criteria. The study aims to recruit 60 participants, divided equally into two groups: Group A and Group B, each consisting of 30 individuals. Inclusion criteria encompass willingness to provide informed consent, being recreational football players within the age range of 8-16 years, and a requirement of playing football at least three times per week. Exclusion criteria involve recent fractures and newly initiated players to ensure a homogenous sample with consistent football experience. Materials essential for the study include a percussion gun for intervention delivery and Likert scales to assess DOMS severity using a Visual Analog Scale (VAS). Additionally, outcome measures comprise the Likert scale for DOMS severity assessment, which will be quantified. Players were divided into 2 groups experimental and non-experimental using random sampling chit method. Group A players were first assessed for soreness and pain using Likert scale for soreness, NPRS and ELY'S Test after their training session. Next the players were given percussion therapy on quadriceps for 2 minutes after training session.

Then they were checked again for DOMS, NPRS and ELY'S test immediately after treatment. Pre and Post results were then compared. Group B players were first assessed for soreness and pain using Likert scale for soreness, NPRS and ELY'S test after their training session. Next the players were given stretching for quadriceps was once for 10-15 seconds. Then they were checked again for DOMS, NPRS and ELY'S test immediately after treatment. Pre and Post results were then compared.

Results

NPRS

This Figure 1 represents NPRS of stretching and percussion therapy. NPRS mean of stretching is 5.10 (std. deviation 1.32 std. error mean 0.24) and for percussion therapy mean is 1.53 (std. deviation 1.04 std. error mean 0.19). The t-test for Pain levels demonstrated a significant group effect ($p<0.001$). Post-treatment analyses revealed that individuals in the stretching group reported significantly higher mean pain scores (5.10) compared to those in the percussion therapy group (1.53).

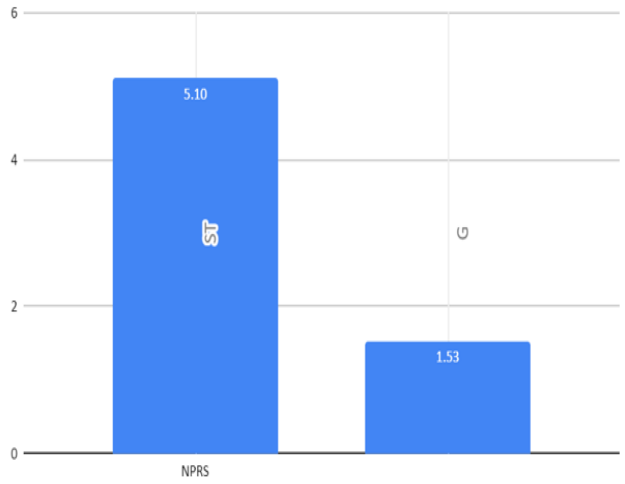

Figure 1. NPRS of stretching and percussion therapy.

Here the post of stretching and percussion therapy have been compared and it shows that the post mean of NPRS OS stretching is 5.10 and mean of post NPRS of percussion therapy is 1.53 indicates that percussion therapy is more beneficial in reducing pain.

ELYS test

The post of stretching and percussion therapy have been compared and it shows that the post mean of ELYS test of stretching group right is 119.23 and same of percussion therapy right is 124.27 and mean of ELYS Test of stretching group left is 119.97 and same of percussion therapy is 125.37 indicates that percussion therapy is more beneficial (Figure 2).

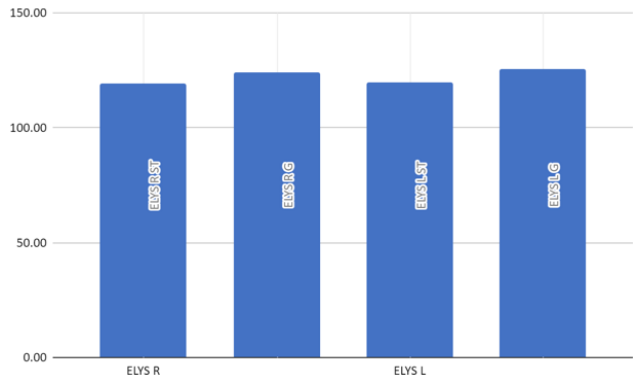

Figure 2. Stretching group *vs.* percussion group.

This represents ELY'S test of stretching and percussion therapy. ELY'S test mean of stretching R post is 119.23 (std. deviation 3.92 std. error mean 0.72) and for percussion therapy R post mean is 124.27 (std. deviation 4.29 std. error mean 0.78). The t-test for increase in range of R leg demonstrated a significant group effect ($p<0.366$). ELY'S test means of stretching left post is 119.97 (std. deviation 3.61 std. error mean 0.66) and for percussion therapy left post mean is 125.37 (std. deviation 3.69 std. error mean 0.67). All the above values show that range is increased by both groups but the percussion gun shows significant more increase in range.

Likert scale for DOMS

As per the above values you can see that the mean decrease of Likert scale for stretching is 2.67 and for percussion is 1.10 which shows that percussion therapy has significant effects on soreness (Figure 3).

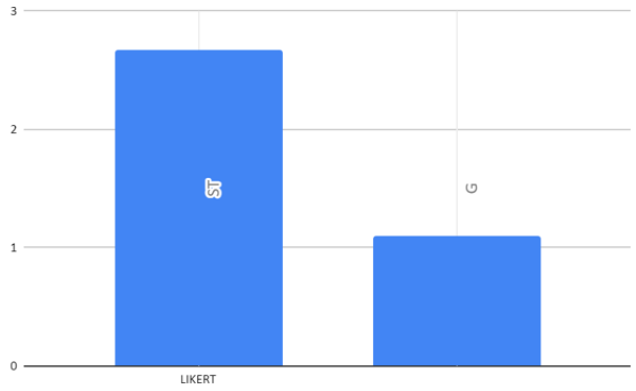

Figure 3. Stretching *vs.* percussion group.

This figure represents Likert scale of DOMS of stretching and percussion therapy after treatment. Likert mean of stretching is 2.67 (std. deviation 0.71 std. error mean 0.13) and for percussion therapy mean is 1.10 (std. deviation 0.76, std. error mean 0.14). The t-test for Soreness levels demonstrated a significant group effect ($p<0.001$). Post-treatment analyses revealed that individuals in the stretching group reported significantly higher mean pain scores (2.67) compared to those in the Percussion therapy group (1.10).

Discussion

The purpose of this study was to compare the effects of a 2-minute percussion therapy (30 seconds at 36 hz/2200 PPM, 60 seconds 45 hz/2750 PPM, 30 seconds 54 hz/3200 PPM) and traditional stretching for DOMS in teenage footballers based on Numeric Pain Rating Scale (NPRS), Likert scale for DOMS, ELY'S test where range of motion were measured using goniometer before and after treatment. In this study a total of 60 participants were included between the age of 12-18 years. The participants were then divided into 2 groups (percussion gun and stretching) by using random sampling chit method. A significant difference amongst both groups was noted in relation to modulation of pain with a mean decrease in NPRS score of 5.1 as compared to 1.53 in percussion gun group immediately after treatment. Out of 60 participants, each and every one experienced a decrease in NPRS but the difference among the group showed that gun is more beneficial. The varied responses from the participants on the pain scale could be explained by the pain gate theory. According to this theory, sensory stimulation can activate either large and fast non-nociceptive fibres (Aβ fibres) resulting in a decrease in pain and/or soreness, or smaller nociceptive fibres (Aδ and C fibres) resulting in aggravation of pain and soreness, for 30 minutes or more thus we are applying the gun for a total of 2 mins (30 seconds at 36 hz/ 2200 PPM, 60 seconds 45 hz/2750 PPM, 30 seconds 54 hz/ 3200 PPM) The possibility exists that applying additional power for the manipulation of muscle tissues could activate mechanoreceptor nerve endings, increasing the sensation of soreness in the muscles right after the massage gun is applied. Further investigation is necessary to determine whether individual differences in tolerance to massage gun speed and amplitude contributed to this slight increase in reported muscular soreness. It is also possible that the high frequency used for the massage guns (~53 Hz, according to Konrad et al.) was a contributing factor. It is crucial to emphasize that massage guns should only be used as tolerated by the individual user and with caution when evaluating this conclusion in light of earlier case reports of major medical problems related to their use. The speed at which the percussion gun compresses the muscle during percussion therapy, when applied to the quadriceps, the muscle may be overstimulating due to the non-nociceptive impulses, occluding the nociceptive impulses. It is believed that when these nociceptive impulses are blocked, there is a relaxing effect that prevents muscular guarding in response to pain or soreness-related sensory input. Similarly, the current study shows that there's a significant increase in ELY'S test of 5 (R), 5.4 (L), post percussion therapy compared to stretching group. ELY's test evaluates the knee's range of flexion and the quadriceps muscle's flexibility. An adjustable and flexible goniometer measuring eighteen inches was used to measure the range of motion. After that, the individual was told to actively complete maximal knee joint flexion while maintaining neutral pelvic alignment and anterior hip joint contact with the rehabilitation couch. The greater trochanter, one of the recognized landmarks, was the location of the measuring apparatus's two arms as it measured the degree of flexion around a

pivot axis that passed through the fibula. The test was performed bilaterally 24. ELY's test showed moderate levels of inter and intrarater reliability (ICC=0.66–0.69) in the study of Peeler and Anderson 200824. In Likert scale, participants would rate their perceived soreness from 1 (no soreness) to 6 (extremely severe soreness). Using an even-numbered 6-point scale avoids a neutral midpoint and forces respondents to make a directional choice towards either less or more soreness. The 6 response options provide more discrimination than a 5-point scale, allowing participants to more precisely rate their degree of muscle soreness. As with any Likert scale, consistency is key-using the same 6-point scale at multiple time points allows for comparison of soreness levels across those time points. In this current study Likert scale for DOMS by percussion therapy showed a mean decrease of 2.9667 compared to stretching which showed a mean decrease of 1.2903 which shows that immediate effects of percussion therapy are better than stretching in reducing DOMS. In this study Likert scale showed improvement in muscle soreness in Quadricep muscle group. According to the study by Trainer JH et al., also found the responses of Likert scale which showed positive result on muscle soreness.

After PT small changes in intramuscular volume have been shown to cause as much as a 50% increase in passive muscle tension, suggesting that increases in local blood flow may account for these reactions. The slower elasticity and relaxation time result could be explained by the higher level of resistance brought on by the increased blood flow. According to these results, Physical Therapy (PT) is comparable to other manual therapies (such manipulative therapy and soft tissue therapies) in that it can produce localized blood flow after application. It has been demonstrated that five minutes of manipulative and soft tissue therapies significantly influences blood flow to the trapezius muscle in patients with neck stiffness and lumbar region in comparison to passive rest during lumbar loading exercise. Improving localized blood flow within working tissue has been associated with improvements in both performance and health related outcomes. Jack H Trainer et al., performed a research on posterior shoulder muscles showed an increase in almost internal rotation range of motion increased by almost 4 degrees following percussion therapy. Currently, there is not enough data to support the short-term usage of massagers to reduce pain and improve range of motion. Previous study has demonstrated that coaches, players, and websites serve as primary sources of information and advice rather than academic journals or medical professionals. This could account for the widespread confidence in these gadgets despite a lack of supporting data from science.

Conclusion

An increasing number OAF therapists and sportsmen are turning to handheld percussion device therapy. According to the current study's findings, majority of participants in this study show significant results with percussion therapy in terms of soreness, pain and range of motion. Both groups showed decreased soreness, pain and increased range of motion after therapy but out of both percussion therapies showed much better results. A single 2-minute treatment might help alleviate the quadriceps soreness and pain, which suggests that percussion therapy is beneficial for individuals who want to recover faster alleviate pain and to perform better.

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