

THE IMPACT OF CORE STRENGTHENING ON LEG EXTENSION STRENGTH AMONG RUNNERS WITH PATELLOFEMORAL PAIN: A PHYSIOTHERAPY INTERVENTION

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ABSTRACT

Core stability, also known as core strength, is the ability to keep your spine and torso in a neutral position while sending the most possible motion to your extremities. By stabilising the spine over the pelvis, a person with a strong core may generate force, transfer it, and control it at the end of an integrated kinetic chain. A person's "core" consists of their spinal cord, pelvis, upper legs, and stomach. The pelvic floor and hip girdle muscles serve as the base of the box, while the diaphragm provides the top. These muscles not only physically stabilise the spine, but also transport and transmit stresses of various types, including compression, translation, and shear, to and from the rest of the body.

Not just among athletes, but also in clinical rehabilitation for extremity-related disorders, the importance of core strengthening and core stability training cannot be overstated. It is possible for the lumbo-pelvic-hip complex to swiftly recover from imbalances when it is stable.

KEY WORDS: *Runner's knee, patellofemoral discomfort, and core strength are all terms used to describe the same condition.*

INTRODUCTION

Patellofemoral pain syndrome (PFPS) is known to be one of the most prevalent knee disorders that 25% of people experience during their lifetime, which is more common among women than men. This disorder is seen in the morning and after waking up, and decreases with the onset of movement and reappears after the onset of activity. The risk factors of this syndrome include quadriceps muscle weakness, patellar displacement, loosening

of ligaments, and stiffness of the external retinaculum, muscle imbalance and weakness in the proximal and distal limbs, overuse syndromes, weakness of the lower limb ligaments such as increased Q angle, poor foot biomechanics, excessive foot pronation in which the foot rotates inward, increase in knee valgus, high body mass index, the abnormal displacement of the patella to the femur. The cause of this displacement has been suggested to be a delay in the onset of activity of the Vastus medialis muscle related to the Vastus lateralis muscle. The primary step in treating patellofemoral pain syndrome is a conservative treatment involving non-surgical interventions, such as rest, ice, anti-inflammatory drugs, activity regulation, and physiotherapy. Physiotherapy includes specific knee exercises, for instance quadriceps muscle strengthening exercises. Studies have shown that with quadriceps muscle exercises people could manage their pain. Stretching exercises, such as iliotibial band stretch, tensor fasciae latae muscle, and hamstrings improve pain. Other treatments include patella taping, foot orthosis, electrotherapy, and biofeedback can be used. Other exercises include strengthening the hip area. Studies have reported significant improvements in pain in people who had hip flexor and extensor

muscles strengthening in their treatment programs. In this regards, the physical therapists or clinicians use selfreported assessment of pain and function to check the effectiveness of various physical therapy interventions. The Visual Analog Scale (VAS) is the most common toolutilized to measure pain intensity, which is believed to be a valid and reliable measure. Core stabilization is of great importance in exercise. That is owing to the fact that it provides stability to the upper parts of the body to perform movements in the lower parts of the body. These muscles' strength allows the system to stabilize the spine mechanically and then distribute and deliver translational, compressive, and shear forces to and from the rest of the body.

LITERATURE REVIEW

Tm ати ати (2023) the purpose of this research was to learn what causes frailty and respiratory muscle weakness in the elderly. All of the 37 people who took part were 65 or older, making them eligible for nursing care in some kind. The rate at which you can take a deep inhale and the length of time you can balance on one foot are two examples. Additionally, a Functional Reach Test (FRT) was conducted. Multiple regression analysis and the Pearson correlation coefficient were also investigated. Improved balance and stability, as well as an increase in the length of time spent standing on one leg, may result from training the muscles of expiration and inspiration in the elderly. Time spent standing on one leg was correlated positively with PEMAX and PIMAX scores but was unrelated to FRT. Only PIMAX remained substantially linked with PEMAX and PIMAX when the time spent standing on one leg was

utilised as the dependent variable in a multivariate regression analysis.

Xiaorui Wang (2022) published his findings on the subject in.The young of today give us hope for the future of our nation because of their boundless energy and creative drive. The youth of every country are its best hope for long-term prosperity. It's possible to identify distinct phases in a young person's philosophical growth. Adolescents develop a sense of good and wrong via interaction with adults and the world around them.

-- (Toshihiro Yoshida). Total knee arthroplasty (TKA) patients who have severe initial pain may experience protracted postoperative discomfort, which may impede the pace at which muscle strength and function recover. Despite the rise in popularity of non-pharmaceutical pain management measures like exercise, medicine is still often used as a first line of defence. The goal of this research was to find out whether a rehabilitation regimen including isometric quadriceps exercises with audible and visual feedback helped patients who had undergone total knee replacement surgery.

Behnaz Tazesh (2021). We settled on a 12-week plan in which you would do five at-home workouts each week. Using the patient's VAS pain ratings and AKPS measures of function, we compared the patient's status before and after treatment. There was a major jump in general productivity. There were statistically significant increases in both function (12.4%) and comfort (6.4%) (CI: 7.1-17.8%, P = 0.003). The results for the intervention group were much better. Incorporating core stability exercises may increase their effectiveness, according to the available studies.

Willy RW (2020) Efforts Made to Recover Retraining is a process that may help alleviate pain and restore movement. Common components of therapies for patellofemoral pain include retraining the patient's movement patterns. That's why we're doing an in-depth analysis of retraining regimens for patellofemoral discomfort. Overall function and symptoms of patellofemoral pain were shown to improve in the vast majority of investigations. The extent to which findings improved and the duration of that improvement varied each study. The best number of sessions for effective and long-lasting pain reduction, according to studies using a fading feedback system, is 8-18 sessions spread out over 2-6 weeks (typically 3-4 sessions per week). Each session lasted between 30-45 minutes longer, for a total of 177-196 minutes, in these trials.

Patellofemoral Joint Mechanics

Due to its robust cartilage and low frictional surface area, the patellofemoral joint can endure significant compression stresses without suffering injury. The trochlear groove and densely nerved bone just below the patella rely on this structure for stability. The patella helps the quadriceps contract, and it also stops the tendon from rubbing against the femur, which may be quite painful. In physics, the moment arm is defined as the angular distance between the tendon's line of action and the axis of rotation of the joint. Moment arm increases by 40% and patellar tendon tension decreases by the same amount because to the existence of a patellar, resulting in a knee-extension moment. We'll go further deeper into this subject in the next paragraphs.

Patellofemoral Joint Pain

Pain in the patellofemoral joint often starts mild and progresses throughout the knee. Common triggers for this pain include running, jumping, and other sports that put pressure on the knee. Examples include prolonged durations of sitting, stair climbing, squatting, kneeling, jogging, leaping, and so forth. It is believed that both internal and environmental factors contribute to patellofemoral joint pain. Excessive pronation, patellar malalignment, trochlear malalignment, a high Q-angle, muscular imbalance, a lack of quadriceps strength, a delay in hamstring activation, and a lack of hamstring strength are all potential underlying reasons. A lack of high-quality training materials or a poor physical site for practising is also possible external reasons. The key difficulty is that there is no one, obvious cause for the onset and maintenance of the illness. Pain is probably caused by a confluence of factors, including those that are physiological, metabolic, biomechanical, and anatomical. Patients who can be helped without surgery (by means such as physiotherapy) are beyond the purview of this study.

Pathophysiology

The biochemical abnormalities of osteoarthritis are milder in the early stages of the condition than they are in the later stages. Water is attracted to healthy cartilage by hydrostatic and osmotic pressure, and is expelled by compression. Osmotic pressure is provided by cartilage proteoglycans and the Gibbs-Donnan effect, while compressive force is provided by collagen fibres.

As the disease progresses, proteoglycan is removed from cartilage and the collagen matrix becomes increasingly disorganised. Deterioration of collagen is the root cause

of fluid retention. The observed uptick may be attributed to the fact that the reduction in osmotic pull caused by collagen loss more than makes up for the loss of proteoglycans.

Strength and Power in the Muscles

One-legged balancing, one-legged squatting, and one-legged standing with three-plane excursion are only some of the approaches that have been suggested for assessing core stability in real-world settings. Trendelenburg posture, arm usage, and postural sway control are just a few examples of how balance while standing may be evaluated. If anomalies are present, the muscles responsible for transferring weight from the hips and stabilising the torso may be compromised. After you've gotten the hang of standing on one leg, you may test your flexibility by crouching on the other. Core instability might show as a high knee valgus moment, excessive trunk motion, or the need to utilise the arms for balance.

Functional Anatomy of Human Knee Joint

The knee comprises of four bones, in particular, femur, tibia, fibula, and patella, and delicate tissues, including ligaments, tendons, muscles and ligaments. Ligaments are situated toward the finish of femur and tibia, and at the rear of patella. They safeguard the bones by giving incredibly dangerous surfaces that permit two unresolved issues on each other. Additionally, they likewise go about as safeguards. Tendons are intense tissues that are joined to two bones. They control the solidness of the knee by obliging the scope of movement of the bones. Muscles are connected to bones through ligaments. They trigger bone movement by moving the pulling powers created from muscle

The knee has two joints, in particular, tibiofemoral (TF) and patella femoral (PF) joints. The two joints comprise of delicate tissues like ligaments, tendons, muscles and ligaments. Ligaments are dainty layers of tissues whose shapes look like those of the bone surfaces that they cover. TF joint has two menisci appended to the tibia that lie between the tibia and the femur.

Methodology

The 1 repetition maximum (RM) test has been performed in a variety of ways throughout the years, but the procedure outlined here is consistent with what has been utilised in the vast majority of recent studies. A variety of rest intervals between sets of the one-repetition maximal test have been used. Studies have varied the time between 1RM efforts from 1-3 minutes. Studies appear to have attained accurate and trustworthy findings, despite the fact that it might be harmful to rest for more than a minute or two after an anaerobic one-repetition maximum (1RM) test.

Therefore, until additional study is conducted on the topic, it is simply advised that while doing 1RM testing, the strength and conditioning coach choose a rest interval (between 1 and 5 minutes) that is optimal for the test subjects and stick to it regularly.

RESULTS

Unpaired t-test comparing group A and group B based on the maximum force produced during leg extensions after treatment. Does GROUP A have much more resources than GROUP B?

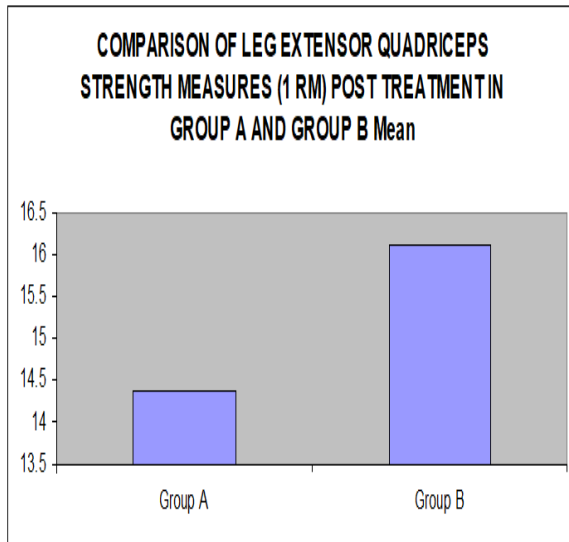
Statistics: P-value

If your P value is smaller than 0.0001 when using a two-tailed test, your findings are highly significant.

T = 4.660 with 302 free variables.

Confidence Interval of 95%

The statistically significant difference between the means of groups A and B is 1.737, with Group B having a lower mean. The range of possible deviations has a 95% confidence interval of 1.003-2.470.



Graph :Group A and Group B Leg Extensors under Review

Is it reasonable to presume that their standard deviations are equivalent?

For T-tests, it is assumed that the populations in each column have the same standard deviation.

The table below contains findings that support or disprove the notion.

$F = 4.239$

The p-value is one in a million, which is very unlikely.

This analysis demonstrates that there is a considerable disparity between the two SDs. To get around the t test's assumption of normally distributed samples, you might do a transformation on your data (reciprocal or log), conduct a nonparametric test, or use the Welch variant of the t test.

Putting Theories to the Test: How closely do sampled data match normal distributions?

For the t test to work, it is assumed that the data are normally distributed. The

Kolmogorov-Smirnov test is used to verify this hypothesis.

Table:Maximum force generated during leg extensions following treatment, contrasting groups A and B with 1 repeat

| Group | KS | p value |
|--------|--------|---------|
| GroupA | 0.2572 | <0.0001 |
| GroupB | 0.1248 | <0.0001 |

The normality test for at least one column failed at the 5% significance level.

Other options include doing a nonparametric test or transforming the data (by means of operations such as logarithmization or reciprocal transformations).

Table:Comparison Summary of Leg Extensor Data

| Parameter | Group A | Group B |
|---------------|---------|---------|
| Mean | 14.388 | 16.125 |
| N= no. | 152 | 152 |
| Std deviation | 4.134 | 2.008 |
| Std error | 0.3353 | 0.1628 |
| Minimum | 11 | 13 |
| Maximum | 59 | 19 |
| Median | 14 | 16 |
| Lower95% | 13.731 | 15.806 |
| Upper 95% | 15.045 | 16.444 |

CONCLUSION

To measure abdominal muscle power, we employ a portable pressure biofeedback instrument. Leg extension capacity is measured by determining the individual's one-repetition maximum. A visual analogue scale was employed to measure patellofemoral pain. Evaluation of Limb and Hand Performance. The measurements taken at the beginning of the study and again six months later are known as "baseline" and "follow-up" measurements, respectively. Six months into data

collection, we employ the students't-test to assess statistical significance.

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