

Profile of Muscle Activation and Co-activation of Quadriceps and Hamstrings Muscle Groups in Patient Osteoarhirtis: Observational Study

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Abstract. Functional problems such as walking are the most common problems in patients with knee OA because this is due to changes in the activity patterns of the quadriceps and hamstrings muscle groups. Objective: to see the activation and co- activation of the muscle groups of quadriceps and hamstrings when walking. This type of research is a cross sectional method, which is emphasizing the time of measurement or observation of data at one time and one time on free and bound variables. The number of respondents is three women. Two respondents had a temporary clinical diagnosis of knee OA, one was a woman who worked in the office for 8 h a day. Using electromyographic placed on the rectus femrois and biceps femoris muscle. Seen while walking on a treadmill. Results In this study there was a co-activation of the hamstrings muscle group especially in the biceps femoris muscle against the quadriceps muscle group especially in the rectus femroris muscle during the early swing phase in all respondents. The largest quadriceps and hamstrings muscle group co-activation ratio occurred in respondents with clinical diagnosis of knee OA with low level activity then respondents with clinical diagnosis of knee high level activity OA and in respondents without clinical complaint of knee OA diagnosis in Surakarta, Central Java.

Keywords: Knee OA · Co-activation · Biceps Femoris · Rectus Femoris · EMG

1 Introduction

Osteoartitis (OA) of the knee is a disease that attacks the knee joint, usually attacks the cartilage in the knee joint [1]. Osteoarthitis (OA) often occurs in the middle and older age groups [2]). This statement is supported by Sharma et al., [3] who say knee OA often occurs in the middle age group and the elderly and is degenerative [4]. Therefore knee OA can be collected is a degenerative disease that attacks the knee joint that occurs in the middle to middle age group. As many as 13% of women in the world when entering the age of 60 years will experience knee OA, and 10% in men when entering the age of 60 years, in Indonesia knee OA of 5% occurs when entering the age of 60 years, while for a population of 15, 5% occur in men and 12.7% occur in women [2].

Functional problems such as walking are the most common problems in patients with knee OA because of changes in the activity patterns of the quadriceps and hamstrings

muscle groups [5]. In normal knee joints quadriceps muscle groups will work to produce shear forces that function to bend the knee joints and prevent the occurrence of knee adduction moments when the walking phase simultaneously hamstrings muscle groups will also work as a stabilator that stabilizes knee extension movements [6].

Patients with knee OA when walking unnoticed will use the hamstrings muscle group more dominantly. This study is proven by testing the pattern of work activity of hamstrings muscle groups using Electromyographic (EMG) [3]. Increased muscle group hamstrings activity by 200 miles second before the heel strike phase and stance phase during the walking phase also occur in patients with knee OA [7].

Electromyographic (EMG) is a technology used to see the work activities of the neuromuscular and motor units to see the activity of contracting muscles [8] In simple terms the mechanism of using EMG is very simple. The EMG will record every mon-traction caused by the muscle that is in contradiction and then the EMG will convert the mechanical signal to an electrical signal [9].

Our hypothesis is that there is a pattern of work activity of the knee joint muscles that changes when walking and to stabilize.

2 Methods

Type of research The research method used in this study is the analytic observational study with a cross sectional approach that is by emphasizing the time of measurement or observation of data once and one time on the free and bound variables. The research was conducted The study was carried out in the RD.1.12 room of the Faculty of Health Sciences, Muhammadiyah University, the knee joint in patients with knee OA. This study will look at Co-activation in patients with knee OA during walking. In addition, this study will also see the dominant contribution of quadricep and hamstrings muscle groups.

Surakarta, Jl. A. Yani Tromol Pos 1 Pabelan, Kartasura, Surakarta, 57162. With the time of the study carried out in January 2020. The subjects in this study were three female clamin types. Two respondents were clinically diagnosed with OA in the knee. Meanwhile, one person is a normal woman working in an office that works for 8 h a day (Fig. 1).

3 Results and Discussion

3.1 Results

From the graph above it can be explained that the activation of the rectus femoris muscle in women with clinical diagnosis of knee OA with high level activity and low level activity and normal women differ during the walking phase. In the early stance phase, 0%-20% is seen as a contrast in the femoral rectus muscle of women with the largest diagnosis of knee OA, which is 57 μ V. The mid stance phase showed that women with low levels of activity had the greatest contraction with 59 μ V. Early swing phase 60% -80%. Women with a diagnosis of high level activity of knee OA have a rectus femoris muscle contraction of 20 μ V and the greatest contrast produced by a normal woman is 42 μ V. In the late swing phase 90–100% of normal women have the largest rectus femoris muscle contraception that is equal to 47 μ V (Fig. 2).



BICEPS FEMORIS

Fig. 1. Graphic Activation of the Rectus Femoris Muscle During the Walking Phase



Rectus Femoris

Fig. 2. Graph of Biceps Femoris Muscle

From the graph above it can be explained that the activation of the biceps femoris muscle in women with diagnosis of knee OA and normal women during the walking phase. In the running phase of early stance 0%-20% visible activation of the biceps femoris muscle in most normal women with a contrast of $100 \,\pi$ V. In the mid swing phase

20%–60% visible biceps femoris muscle activity in women with clinical diagnosis of knee low level activity OA with a contrast of 104 π V. In the early swing phase 60%–80% activation of the bicep femoris muscle is seen in women with a diagnosis of knee OA with low level of activity still high at 131 π V. In the late swing phase 80%–100% seen that biceps femoris muscle activation in normal women has a large value that is 104 π V. The highest peak of activation in women with a diagnosis of high level activity of knee OA is in the late swing phase of 60%–80% with muscle activation of 70 π V. In the provincial women diagnosed with OA with the lowest level of contraction, the greatest contraction also occurred in the late swing phase, namely with 131 π V contraction. For normal women, the greatest contraction occurs in the late swing phase 90%–100%, with muscle activation of 104 π V.

3.2 Discussion

Knee OA usually starts in the middle and lower age groups with the highest prevalence in women [10] Specifically, it cannot be clearly explained why women are more often exposed to knee OA than men but, differences in anatomic structure are the most influential factors such as narrower femur, thin patella, larger Q-angle and differences in the size of the tibial condylar [11]. Another factor that allows women more often exposed to knee OA is that women tend to lose volume in the knee cartilage faster than men, so there is an increase in friction in the tibiofemoral cartilage [12]. From the explanation above we make the reason why we choose respondents with female gender.

Knee OA is often associated with a decrease in knee joint stability due to changes in altered joint structure, [7]. In this recipe the study changes the knee structure which is more outward. This is also supported by the influence of O-angle on our respondents. There is a study that supports that changes in the shape of the knee structure and the effect of q-angle can increase the risk of knee problems [13]. This is the basis for which we want to see activation and co-activation in the quadriceps and hamstrings muscle groups during the walking phase in patients diagnosed with knee OA. The walking patterns of women with a diagnosis of knee OA and women without clinical diagnosis of knee OA are basically the same [14]. However, we see a comparison of the pattern of activation ratio of biceps femoris muscle to rectus femoris muscle which increased in our respondents during the early swing phase. The ratio of quadriceps muscle groups and hamstrings during walking to keep the knees stable is 1:1 [15]. However, we did not see this in patients with clinical diagnosis of knee OA, especially in the early swing phase when walking. This is caused because when walking in the early swing phase the state of the body goes in the phase of single of support and break with multiple joints (journals). This also happened to our respondents where respondents with clinical diagnosis of knee low level activity OA occurred in a ratio of work ratio of quadriceps and hamstrings muscle groups of 1:4.5 followed by women with women with clinical diagnosis of knee high level activity OA of 1:3 and finally normal women in the ratio of 1:2.5.

The greatest increase in activation patterns in the biceps femoris muscle against the rectus femoris muscle occurs in respondents with clinical diagnosis of low- level knee OA activity, this is likely due to additional symptoms such as deformity, crepitation, joint tenderness and local edema. However, further research is needed to be able to

demonstrate clinically the influence of the additional symptom. In addition, increased activation of biceps femoris muscle also occurs in normal women and is even greater than respondents with clinical diagnosis of high level activity of knee OA. Researchers have conducted a re-assessment using the guideline to diagnose problems in the area around the knee but the results are negative. The high activation of female bicep femoris muscle without being able to be caused due to muscle amnesia in the gluteus medius muscle [16]. However further research and learning about this discovery are needed.

4 Conclusion

In this study, there was co-activation of the hamstrings muscle group, especially in the biceps femoris muscle against the quadriceps muscle group, especially in the rectus femroris muscle during the early swing phase in all respondents. The largest quadriceps and hamstrings muscle group co- activation ratio occurred in respondents with clinical diagnosis of knee OA with low level activity then respondents with clinical diagnosis of knee high level activity OA and in respondents without clinical complaint of knee OA diagnosis in Surakarta, Central Java.

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