

Effect of Footwear on Strength of Vastus Medialis Obliques- to Check by Using Pressure Biofeedback

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Abstract

Background: - While using footwear, directly or indirectly the muscle force passing through the lower extremity such as knee so, the present study was conducted to analyze the muscle activity of vastus medialis obliquus in Female who are wearing shoes and who are wearing high heels. It is necessary to investigate the effect of heel height on activation of vastus medialis obliquus muscles.

Methods:-To check the strength of vastus medialis obliquus in Individuals 50 subjects were divided into two groups, Group 1 had individual wearing shoes and group 2 had individual wearing high heels. Strength of vastus medialis obliquus was assessed using pressure Biofeedback for both the groups.

Result:-Unpaired t test was used in between and paired t test was used in the groups to analyze the data. There was a significant difference in the strength of vastus medialis obliquus between both the groups(p <0.001).

Conclusion: -This study concludes that Females wearing heels had significantly decreased vastus medialis obliquus strength compare to the Subjects who wear Shoes.

Key Words: Heel, Patellar syndrome, Pressure biofeedback, Knee Pain, VMO strength

Introduction

Type of footwear affect the loading pattern in lower limbs. Also, lower extremity is a unit that is well interrelated with functional and mechanical activity.⁽¹⁰⁾ Hence, while using footwear, directly or indirectly the muscle force passing through the lower extremity such as knee.

The VMO is an important component of quadriceps responsible for the stabilization and protection of the knee joint.⁽²⁾It Promotes medial patellar Tracking and counteract the lateral pull of the Vastus Latralis.

^(3, 4)Evidence show that shoe heel height may affect muscle activation of this muscle. High heels tend to increase vertical and anterior-posterior ground reaction forces during walking or any other dynamic postures.⁽¹¹⁾ Also there is increase in external adduction moment leading to increased medial Compartment load. Thus ultimately it leads to increase VMO activity.⁽⁶⁾

The imbalance of forces between the VMO and VL and difference in activation will lead to improper position of patella, and thus pain while performing any task.⁽¹⁾ But what is the difference in the strength of VMO who are wearing shoes and who are wearing heel that is still questionable. Hence the purpose of this study is to assess the effect of shoes and heels on VMO strength.

Material and Method

This study was conducted at UkaTarsadia University Maliba campus bardoli in 2017. One time observational

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study, in those 50 subjects was included with the age group between 18 to 25 years. In those 25 subjects who wear high heels that is 4 to 5 cm height with more than 5 hours per day and more than 6 months. Remaining 25 subjects, who wear shoes more than 5 hours a day. Subjects having any musculoskeletal pain, trauma, or undergone for any surgery of lower limb were excluded.

The study was approved by institutional committee of ethics of Shrimad Rajchandra College of physiotherapy. The subjects were divided into two groups by convenient sampling: Group (a) who wear high heels, Group (b) who wear comfortable shoes. Strength of VMO was measured by pressure biofeedback. Subjects were asked to sit in long sitting and were told to maintain the pressure biofeedback at a baseline of 100 mm of hg. Inflated cuff of pressure biofeedback was placed under the 10 to 15 degree of flexed knee of subject and were instructed to perform isometric contraction of the quadriceps and pressure difference was noted down following isometric quadriceps contraction.

Normal value for isometric contraction of quadriceps was increasing it upto 90 mm/hg.⁽⁷⁾ Then subjects were asked to perform isometric contraction of quadriceps with hold time of 5-8s. Three trials were taken and whether subject could hold the pressure or not.



Figure 1: The unit was placed under the knee and procedure was carried out with ankle in contact to the couch while the trunk is inclined with hand support.

Results and Discussion

Data obtained were analysed using SPSS 16.0 and tested for significance by the unpaired one-tailed student's t-test was used for between group comparison and Paired t- test was used for within group comparison. Level of significance set at $p < 0.05$.

Table 1: Demographic data

Characteristics	Group 1(Shoes)		Group 2(Heel)	
	Mean	SD	Mean	SD
Age	19.92	1.552417	21.16	1.795364401
Working hours	7	0.912871	5.2	0.96

Table 2: Compression between group 1 (Shoes group) and Group 2 (Heel group)

		Mean Pressure	MD	T	P
Right side	Group :-1 (Shoes)	183.64	40.88	8.38	0.0001
	Group:-2 (Heel)	142.76			
Left side	Group :-1 (Shoes)	182.84	31.88	6.58	0.0001
	Group:-2 (Heel)	150.96			

Result shows statistically significant difference of VMO strength between Shoes and heel group ($p > 0.05$). While comparing the strength of VMO between right and left leg in heel group show statistically significant difference ($p > 0.05$).

Footwear is a fundamental garment that is found in most communities around the world. ⁽⁸⁾Shoes can have a significant impact on lower limb muscles. Decreases in muscle strength are associated with reductions in functioning when performing the tasks of daily living.

The results showed that high heel use interfered with VMO muscle strength in healthy females. In Female from the shoes group, no significant differences were registered in strength of VMO Between right and left leg; however, the use of high heels caused changes in Strength of VMO between Right and Left leg. Strength of VMO decreased especially in the Non dominant leg. ⁽⁸⁾

Cheung et al said that subject who are wearing motion control shoe they have significantly earlier onset of VMO relative to VL compare to cushion shoe. ⁽⁸⁾ In Our study we used normal sports shoes in that group we found strength of VMO is more compare to females with high heel.

In present study height of heel is between 4 to 7cm. Edward et al. They found that in healthy women, as heel height increased during sitting to stand there was an increase in EMG activity in both VM and VL activity. VL activity was increased significantly in 3 and 5 cm heel height. But for only 5 cm heel height VM activity was increased. No statistically significant change in the VM: VL ratio was observed. ⁽⁵⁾

To Considering the proposed importance of VMO and VL muscles activity in knee stability. ⁽⁹⁾Ho et al. Found that high-heeled shoes increase the tension of the patellofemoral joint due to increased knee extensor moment. ⁽¹⁾While Simonsen et al. showed that high heels cause the knee to abduct. According to these authors, the changes in internal moments in both the sagittal and frontal planes would be related to the increase in EMG activity of the knee extensor muscles, and to the greater stress on the patellofemoral joint, resulting from changes in patellar movement. ⁽¹⁾

However, a big increase within the inward moment caused by the lateral knee muscles may also increase the lateral slip of the knee. Therefore, the hyperbolic activity of the VL muscle should be followed by a synchronal increase in VMO, thus as for a balance of forces to occur and to avoid sesamoid bone lateral shift.

Some authors suggest that this decrease in the VMO: VL ratio is the consequence of a neuromuscular imbalance, which could be caused by alterations in the neurophysiological mechanism. This is because the presence of pain or inflammation signals in the knee joint has been reported to be responsible for inhibition of the quadriceps muscle, and the VMO muscle is most affected. Stefanyshyn DJ, et al conclude that walking in high-heeled shoes may lead to prolonged increases in RF activity particularly with heel heights > 4 cm, which could lead to knee overload. Which could leads to knee overload and it May leads muscle fatigue may be this was a reason why we found decreased VMO strength in females who were wearing high heel. ⁽¹¹⁾

Conclusion

We conclude that female who wearing high heel in that VMO strength is decreased compare female who wearing shoes. So it was suggested that permanent wearing of heeled foot wear could contribute to muscle overuse, repetitive strain injury and more prone for knees pathology compare to female wearing shoes.

Ethical Clearance- Taken from Institution Ethical committee.

Source of Funding- Self

Conflict of Interest – Nil

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