



HIP MUSCLES AND QUADRICEPS STRENGTHENING EXERCISES IN OSTEOARTHRITIS KNEE – EVIDENCE BASED CASE STUDY REPORT

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ABSTRACT

Musculoskeletal conditions are a diverse group with regard to pathophysiology but are linked anatomically and by their association with pain and impaired physical function, including osteoarthritis a major condition. Most common is osteoarthritis of the knee joint which is characterized by focal areas of loss of articular cartilage with in synovial joints, which are associated with hypertrophy of bone and thickening of the capsule. Osteoarthritis is an enormous public health problem in developed countries and osteoarthritis knee remains a leading cause of Musculo skeletal pain and disability Aims and Objectives of this case study was to analyse specific hip and knee exercises in improving clinical means and functional activities. Quadriceps and bilateral hip abductor strengthening exercises with more emphasis for 14 physiotherapy sessions in 2 months duration womac score has shown ($P<.001$) statistically highly significant results and an improved cadence with statistical significant results ($P<.05$). Hence strengthening of specific muscles based on evaluation was effective among osteoarthritis knee subjects was the major or findings to be considered during exercise prescription among patients with osteoarthritis of knee.

Keywords: body mass index, womac score, cadence, range of motion, osteoarthritis



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INTRODUCTION

Osteoarthritis is characterized by pain, disability and progressive loss of function is associated with significant health and welfare costs¹. Pathologic changes in osteoarthritis involves the whole joint in the form of focal and progressive hyaline articular cartilage loss with concomitant changes in the bone under health the cartilage including development of marginal outgrowths, osteophytes and increased thickness of the bony envelope soft tissues in and around the joint are also affected². Knee is the most frequently affected joint of the lower limb³. Patients with knee osteoarthritis report pain and difficulty with functional activities such as prolonged sitting, ascending and descending stairs, walking, squatting, rising from a chair and getting in and out of a car⁴ thus leads to a loss of functional independence and reduced quality of life⁵. In patients with osteoarthritis, regular exercises can improve pain control, proprioception, controlled strength, instability and endurance, all of which improve functional independence⁶. Globally about 17% of people aged over 45 years suffer from pain and loss of function due to symptomatic osteoarthritis knee⁷. Risk factors for osteoarthritis include female gender, and obesity⁸. Individuals with osteoarthritis of the knee joint commonly display marked weakness of the quadriceps muscles with strength deficits of 20-40% compared with aged and gender matched controls⁹. People with osteoarthritis exhibit significant strength deficits of hip muscles¹⁰. Hence muscle strengthening is an important point in the rehabilitation process¹¹. The aim of this case study was to analyse the impact of strengthening exercises to hip muscles and quadriceps in particular in

improving pain, and physical functions of this subject with osteoarthritis knee.

BACKGROUND INFORMATION

- This female subject with post menopausal, being mesomorph, vegetarian, professionally a chartered accountant with sedentary lifestyle with known type II diabetic and hypertensive, getting treated by physician with the following drug therapy T. Reclimet, T. Tretiva 20 mg, T. Volibo 3mg and T. Rozel 10mg. Blood Sugar Profile: FBS – 166 mg, PPBS – 275 mg, hba_{1c} – 11.8%
- Anthropometric findings:
Body Weight: 63 kg, Height: 152cm, Waist Circumference: 89cm, BMI: 27 kg/m² Resting heart rate: 84/mt Blood Pressure: 136/86 mm/Hg

C/O

Right knee with pain, difficulty in transfer activities and walking

O/B

- Ambulant with stiff knee gait
- Crepitus mild increasing on movements of both knee left > right

O/E

- Pain over medial joint line (Right) knee with grade two tenderness
- Patella movements stiff and restricted
- Active knee flexion beyond 40 restricted due to pain and apprehension in sitting position and while walking.
- Evaluation of this subject motor Power of left and right hip and knee muscles

Table 1

Region	Muscles	Right	Left
Knee	Quadriceps	3/5	4/5
	Hamstrings	3/5	4/5
	Flexors	2/5	3/5
Hip	Extensors	3/5	4/5
	Abductors	3/5	4/5
	Adductors	4/5	4/5

- Active ROM in prone lying right knee 0⁰-60⁰, left 0⁰-90⁰
- Mild hip flexor and adductor tightness of right hip
- Exaggerated lumbar lordosis with isometric abdominal muscles grade III/ V and spinal muscles III / V
- Moderate exercise tolerance: standing X-ray revealed: Early arthritic changes with diminished right medial joint space of knee and Mild osteophytes

Strengthening exercises to both lower extremities in supine, side, prone and sitting positions

1. Lateral, supine and prone plank posture exercises using Physioball
2. Patella glides and Mobilization of both knee and hip joints

FREQUENCY

Weekly twice, each session with a duration of 25-30 minutes set of 12 exercises, repetitions increased gradually total number of sessions: 14. She was advised to continue home exercises and walk regularly for 20-25 minutes 5 days / week, apart from was treated once a week in the centre with physiotherapy.

PROVISIONAL DIAGNOSIS

Bilateral Osteoarthrosis knee Treatment given during the months of August and September 2016

RESULTS

Recorded data were statically analyzed using SPSS software and displays as below

Table 2
Results of Pre and Post ROM and Motor Power

	ROM	Cadence / Minute	Womac %	Motor Power Right Lower Extremity
Pre	Knee Right 0 ^o -60 ^o Left 0 ^o -90 ^o	20	69%	Hip: Abductors 3/5 & Extensors 3/5 Knee: Hamstrings 3/5 and Quadriceps 3/5
Post	Right 0 ^o -110 ^o Left 0 ^o -120 ^o	32	21%	Hip: Abductors and Extensors 4/5 Knee: Hamstrings, 4/5 Quadriceps 3/5

Table 3
Results of unpaired 't' test for womac score of this subject

Df	SE	t	P
4	5.32	9.01	P<.001 XX

XX Highly Significant Statistically

Table 4
Results of unpaired 't' test for cadence / minute of this study subject

	SE	t	P
4	4.04	2.96	P<.05 X

X Statically Significant

DISCUSSION

With an improved womac score cadence, gait and range of motion of this study subject, the following question arises a) Is motor weakness of quadriceps, hip muscles associated with osteoarthritis knee? b) Muscle weakness around knee related to pain and physical function? C) Does strengthening exercises improves quality of life among osteoarthritis knee subjects. Association of motor weakness of quadriceps and hip muscles in osteoarthritis knee were evidenced by the following studies: People with osteoarthritis knee exhibit significant strength deficits of the hip muscles in a study and 89 people with osteoarthritis knee conducted by¹⁰, also this case study subject has weak hip abductors and extensors.¹² have found that quadriceps lean muscle cross – sectional area was 12% lower in the affected limb with osteoarthritis than contra lateral unaffected limb. This subject also was found to have weak quadriceps strength.¹³ in a meta analysis have identified that resistance exercises were effective in terms of improving pain and function, which is worthy mentioning as this study subject was treated with resisted exercises using Physioball have reasonably improved with her pain and physical function .As inferred from table 4 showing the subject with an improved cadence with statistical evidence. Muscle weakness has been shown to be associated with greater levels of disability in patients with osteoarthritis knee ¹⁴ and may be precursor to osteoarthritis knee ¹⁵. Resistance training has been found to increase overall habitual physical activity levels¹⁶ and minimize loss of lean muscle mass ¹⁷hip muscle strengthening may protect against disease progression in subjects with

osteoarthritis knee which was supported by two studies ¹⁸⁻¹⁹. In line with these Studies this study subject who was treated with strengthening exercises to both hip joint muscles have benefited against progression of her osteoarthritis knee.²⁰ Have recorded greater improvements in pain and function with 12 supervised Exercise sessions in subjects with osteoarthritis knee, similar to these findings this study subject with 14 sessions of supervised exercises has shown significant progression in terms of pain reduction and improved physical function²¹. As shown in table 3 of highly statistically significant with womac score as a subjective measure of functional outcome. Have recorded that quadriceps strengthening did not significantly alter the knee adduction moment in people with knee osteoarthritis. Few other studies which have failed to find a relationship between baseline quadriceps muscle strengthening and subsequent disease progression ²².

CONCLUSION

Routine Physiotherapeutic management of subjects was to use electrotherapy modalities for pain relief, teach fewer isometric and mobilization exercises to the affected leg. But this study where strengthening of both hip abductors, knee extensors with resisted means were found to be more effective in promoting patients recovery functionally. But larger sample size and long term follow up are required to validate this study further. Future studies with EMG, other gait parameters other antigravity muscles and including men with osteoarthritis are recommended.

REFERENCE

1. March LM, Bachmeier CJ. Economics of osteoarthritis: a global perspective. *BaillieresClinRheumatol*. 1997 Nov; 11(4):817-34.
2. Felson DT, Lawrence RC, Dieppe PA. Osteoarthritis: new insights. Part 1: the disease and its risk factors. *Ann Intern Med*. 2000 Oct 17; 133(8):635-46.
3. Felson DT, Zhang Y, Hannan MT, Naimark A, Weissman BN, Aliabadi P, Levy D. The incidence and natural history of knee osteoarthritis in the elderly. The Framingham Osteoarthritis Study. *Arthritis Rheum*. 1995 Oct; 38(10):1500-5.
4. AAGuccione, D T Felson, J J Anderson. The effects of specific medical conditions on the functional limitations of elders in the Framingham Study. *Am J Public Health*. 1994 March; 84(3): 351-8.
5. Jordan J, Luta G, Renner J, Dragomir A, Hochberg M, Fryer J. Knee pain and knee osteoarthritis severity in self-reported task specific disability: the Johnston County Osteoarthritis Project. *J Rheumatol*. 1997 Jul;24(7):1344-9.
6. Baker K, McAlindon T. Exercise for knee osteoarthritis. *CurrOpinRheumatol*. 2000 Sep; 12(5):456-63.
7. Dawson J, Linsell L, Zondervan K, Rose P. Epidemiology of hip and knee pain and its impact on overall health status in older adults. *Rheumatology (Oxford)*. 2004 Apr; 43(4):497-504.
8. Felson DT, Zhang Y. An update on the epidemiology of knee and hip osteoarthritis with a view to prevention. *Arthritis Rheum*. 1998 Aug; 41(8):1343-55.
9. Jayanta Nath. Knee osteoarthritis with special emphasis to physiotherapy treatment focusing various stimulation Technique. *International Journal of Scientific and Research Publications*, Volume 5, Issue 3, March 2015
10. Hinman RS, Hunt MA, Creaby MW, Wrigley TV, McManus FJ, Bennell KL. Hip muscle weakness in individuals with medial knee osteoarthritis. *Arthritis Care Res (Hoboken)*. 2010 Aug; 62(8):1190-3.
11. Vaz MA, Baroni BM, Geremia JM, Lanferdini FJ, Mayer A, Arampatzis A, Herzog W. Neuromuscular electrical stimulation (NMES) reduces structural and functional losses of quadriceps muscle and improves health status in patients with knee osteoarthritis. *J Orthop Res*. 2013 Apr; 31(4):511-6.
12. Petterson SC, Barrance P, Buchanan T, Binder-Macleod S, Snyder-Mackler L. Mechanisms underlying quadriceps weakness in knee osteoarthritis. *Med Sci Sports Exerc*. 2008 Mar;40(3):422-7.
13. Pelland L, Brosseau L, Wells G, Macleay L, Lambert J, Lamothe C, Robinson V, Tugwell P. Efficacy of strengthening exercises for osteoarthritis (part I): a meta analysis. *Physical Therapy Reviews* 2004; 9(2): 77-108.
14. Fitzgerald GK, Piva SR, Irrgang JJ, Bouzubar F, Starz TW. Quadriceps activation failure as a moderator of the relationship between quadriceps strength and physical function in individuals with knee osteoarthritis. *Arthritis Rheum*. 2004 Feb 15; 51(1):40-8.
15. Slemenda C, Heilman DK, Brandt KD, Katz BP, Mazzuca SA, Braunstein EM, Byrd D. Reduced quadriceps strength relative to body weight: a risk factor for knee osteoarthritis in women? *Arthritis Rheum*. 1998 Nov; 41(11):1951-9.
16. N. Farr, Scott B. Going, Timothy G. Lohman, Lucinda Rankin, Shelley Kastle,³ Michelle Cornett, and Ellen Cussler. Physical Activity Levels in Early Knee Osteoarthritis Patients Measured by Accelerometry. *Arthritis Rheum*. 2008 Sep 15; 59(9): 1229-1236.
17. Toda Y. The effect of energy restriction, walking, and exercise on lower extremity lean body mass in obese women with osteoarthritis of the knee. *J Orthop Sci*. 2001; 6(2):148-54.
18. Chang A, Hayes K, Dunlop D, Song J, Hurwitz D, Cahue S, Sharma L. Hip abduction moment and protection against medial tibiofemoral osteoarthritis progression. *Arthritis Rheum*. 2005 Nov; 52(11):3515-9.
19. Bennell KL, Hunt MA, Wrigley TV, Hunter DJ, McManus FJ, Hodges PW, Li L, Hinman RS. Hip strengthening reduces symptoms but not knee load in people with medial knee osteoarthritis and varusmalalignment: a randomised controlled trial. *Osteoarthritis Cartilage*. 2010 May; 18(5):621-8.
20. Fransen M, McConnell S. Exercise for osteoarthritis of the knee. *Cochrane Database Syst Rev*. 2008 Oct 8 ;(4):CD004376. doi: 10.1002/14651858.CD004376.pub2.
21. Zhao D, Banks SA, Mitchell KH, D'Lima DD, Colwell CW Jr, Fregly BJ. Correlation between the knee adduction torque and medial contact force for a variety of gait patterns. *J Orthop Res*. 2007 Jun; 25(6):789-97.
22. Amin S, Baker K, Niu J, Clancy M, Goggins J, Guermazi A, Grigoryan M, Hunter DJ, Felson DT. Quadriceps strength and the risk of cartilage loss and symptom progression in knee osteoarthritis. *Arthritis Rheum*. 2009 Jan; 60(1):189-9.

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