



ISSN NO. 2320-5407

Journal homepage: <http://www.journalijar.com>
Journal DOI: [10.21474/IJAR01](https://doi.org/10.21474/IJAR01)

**INTERNATIONAL JOURNAL
OF ADVANCED RESEARCH**

RESEARCH ARTICLE

The Effects of Functional Task Training versus Progressive Resistance exercises on OA Knee.

Krishna Kumar Singh.

Professor & Principal, Jaipur Physiotherapy College, Maharaj Vinayak Global University Jaipur.

Manuscript Info

Manuscript History:

Received: 18 May 2016
Final Accepted: 25 June 2016
Published Online: July 2016

Key words:

Functional Task Training,
Traditional exercises, OA Knee,
Progressive Resistance Exercises
(PRE), Visual analogue scale
(VAS), Walking speed test, Step
Test.

*Corresponding Author

Krishna Kumar Singh.

Abstract

Aims & Objectives: To investigate the efficacy of functional task training in decreasing pain, and increasing functional mobility in Osteoarthritis Knee. **Study design:** Comparative case control study. **Methodology:** Thirty subjects with a diagnosis of OA Knee were selected directly from Physiotherapy outpatient door of Jaipur Physiotherapy College, MVGU, Jaipur. These individuals were randomly assigned into two groups: FTT Group [Functional task Training (n = 15)] and PRE Group [Progressive Resistance Exercise (n = 15)]. FTT Group Functional tasks included sit to stand box lift, standing star exercise, walking up and down a ramp while holding a weight, ascending/descending stairs while holding a weight in the preferred hand, and walking indoors while passing a weighted ball from hand to hand. Subjects performed the exercises for one minute with (when indicated) a one-pound weight. Progressions included either an increase in weight or time to perform the activity. Subjects in the *PRE program performed* three exercises (two exercises for quadriceps strengthening and one for hamstrings strengthening), for the first 6 weeks all the exercises were given with 1kg weight and for the next 6 weeks exercises were given with 1.5kg weight. Patients were instructed to do each exercise Twenty five to thirty repetitions in one set and single set is done by patient in one treatment session. Both the groups were given exercises supervised by physiotherapist on regular basis for 12 weeks. Data for measurements of pain on VAS scale, Balance & mobility on Step Test & Walking speed Test was collected on day 1 (pre treatment session), at 6 weeks, and at week 12. **Results:** Results indicate that both groups improved in all measures of pain, Balance and functional outcomes. However, upon intergroup analysis the mean changes in the score of VAS, Step Test & Walking Speed Test was highly significant across the two testing periods (at 6 week & 12 week) for the functional task training group (FTT). **Conclusion:** Functional task training on regular basis is an effective rehabilitation program and is better than PRE for improving functional mobility, balance and decreasing pain in OA Knee.

Copy Right, IJAR, 2016,. All rights reserved.

Introduction:-

Osteoarthritis (OA) most commonly affects the knee joint (Zhang and Jordan, 2010)¹. Knee OA is defined as a clinical syndrome of joint pain accompanied by varying degrees of functional limitation and reduced quality of life (The Royal Australian College of General Practitioners (RACGP), 2009).² Osteoarthritis (OA) is a degenerative articular disease which is slowly evolving that appears to originate in the cartilage by breaking down and affects the underlying bone, soft tissues, and synovial fluid (Gur H, C, akın N. 2003).³ The prevalence of symptomatic knee OA in developed countries is estimated at five per cent for adults between the ages of 26 and 45 years; 17% for adults above the age of 45 years; and 12.1% for adults over the age of 60 years (American Academy of Orthopaedic Surgeons (AAOS), 2008).⁴ Knee OA has a significant impact on function and quality of life. Recurrent knee pain is

the primary symptom affecting crucial functional activities, including walking (Zhang and Jordan, 2010). Other knee OA-associated symptoms such as stiffness and muscle weakness further impairs function and has an impact on societal, recreational and occupation-related activities (Walsh and Hurley, 2008). Management of chronic knee OA symptoms primarily includes pharmacological, physiotherapeutic and surgical interventions (RACGP, 2009).² Considerable evidence in the literature confirms that strengthening exercises should be employed in the treatment of knee OA; however, confusion exists as to what exercises are the most appropriate and beneficial in meeting the needs of the patient with OA (Brousseau et al., 2005).⁵ Traditional exercises tend to focus on the isolation of one or more muscle groups (e.g., quadriceps) in an attempt to address the impairment. Alternately, functional task training focuses at the activity level by strengthening and adapting postural strategies to environmental demands through functional task performance.

In a pilot study of 45-65 year old knee OA subjects, who were randomized to either a functional task training or traditional exercise group, Stutz-Doyle (2009) found the functional task training group demonstrated a significant increase in quadriceps muscle strength and gait velocity as well as greater improvements in TUG scores as compared to traditional exercise group.⁶ Since there is limited information regarding the benefit of functional task training programs in the OA population over strength training exercises/Progressive resistance exercise (PRE), further investigation is warranted in the knee OA population; therefore, the purpose of this study was to investigate whether functional task training would be more effective in decreasing pain, and increasing balance & functional mobility in this population.

Material & Methods:-

- **Evaluation of the study subjects:-**

A sample of 30 patients who were diagnosed with OA Knee and who fulfilled the inclusion criteria were referred to outpatient physiotherapy department of Jaipur physiotherapy college, MVGU, Jaipur and after obtaining informed consent they recruited for this study. A sample of 30 patients was assigned in two groups, the Progressive Resistance exercise group (PRE) or the Functional task training group (FTT).

- **Inclusion Criteria:-**

Both Male & female patients age ranged between 50- 65 years, had knee pain of four months or longer, able to walk 100 feet without resting and without an assistive device, able to ascend & descend 9 stairs, able to lift a 4 pound box from the floor and stand up, not taking anti-inflammatory medication and diagnosis of knee OA based on radiographic results obtained by physician report.

- **Exclusion Criteria:-**

Neurological disease, uncontrolled low or high blood pressure, uncontrolled cardiopulmonary or respiratory condition, inability to rise from and return to a chair without assistance, any additional musculoskeletal diseases or surgeries and currently actively participating in an exercise program.

Outcome measures:-

- **Visual Analogue scale (VAS):-**

Knee pain was recorded on (VAS) which is a 10 cm horizontal line, 0 represented no pain while 10 represented extremely intense pain. VAS was given to all participants and was asked to place a vertical mark along the line where they feel pain. VAS provides a reliable method for measuring pain and is sufficiently sensitive to detect distinct differences in pain experience.⁷

- **Walking speed test:-**

This was a 5 meter walking time. Subjects were asked to walk for a total of 8 meters in order to minimize the influence of acceleration and deceleration at the onset and conclusion of task, the 5 meter time was recorded during the middle of 8 meter.⁸

- **Step test:-**

In this test subjects were asked to stand on the osteoarthritic limb, while opposite knee was kept over the stool of height 15 cm. subjects stood on the osteoarthritic limb, while stepping the opposite foot on and off the step as many times as possible over 15 sec. The number of repetitions were taken the participants could place the foot on the step and return it to the floor was noted.⁹

Procedure:-**• Exercise Protocols:-**

The PRE program consisted of exercises that targeted the level of impairment (muscle strength), while the FTT program concentrated on exercises concerned with the body as a whole. The intensity of exercise was monitored based on the Borg Perceived Exertion Scale. The resistance load is equated with a moderately intense rating (#3) on the scale.

Subjects in the *PRE program performed* three exercises (two exercises for quadriceps strengthening and one for hamstrings strengthening), For the first 6 weeks all the exercises were given with 1kg weight and for the next 6 weeks exercises were given with 1.5kg weight. Weight cuff were tied at end of the leg in all the exercises. For quadriceps strengthening, Knee extension in high sitting position and short arc knee extension in supine lying position with weight cuff were given. For Hamstring strengthening, Patient prone lying knee flexion with weight cuff was given. Patients were instructed to do each exercise Twenty five to thirty repetitions in one set and single set is done by patient in one treatment session. Patients were allowed to take break if they complain of tiredness or discomfort.¹⁰

Functional tasks (FTT) included sit to stand box lift, standing star exercise, walking up and down a ramp while holding a weight, ascending/descending stairs while holding a weight in the preferred hand, and walking indoors while passing a weighted ball from hand to hand. All exercises were supervised by the Physiotherapist. Subjects performed each exercise for one minute with (when indicated) a one pound weight. Progressions included either an increase in weight or time to perform the activity.¹¹

Data collection:-

Performance measure tests were completed at *Day 1 (Pre treatment session)*, *six week* and *twelve week* periods.

Statistical Analysis:-

SPSS statistical software 21 version was used for data analysis. Comparison between the two groups was done on *Paired t- test*.

Result:-

In this study ***Paired t- test*** was used for all the three variables, namely VAS, Walking speed Test and Step Test. The variables with respect to the subjects recorded were clearly insignificant at Day 1 (pre treatment session) when compared against each other namely Progressive Resistance exercise group (PRE) or the Functional task training group (FTT).

VAS:-**Intergroup analysis:-**

The intergroup analysis with respect to the variable VAS is reflected in (table1. figure- 1). The overall data which was analyzed revealed significant improvement on the effective variable in both the groups. There was an insignificant difference between FTT Group and PRE Group at Day-1 (Pre-Test) with t value=0.326699, $p < 0.05$. There was a significant difference between FTT Group and PRE Group at Week 6 ((table1. figure- 1.) with t value=2.82137, $p < 0.05$. There was a significant difference between FTT Group and PRE Group at Week 12 ((table1. figure- 1.) with t value=9.88929, $p < 0.05$.

Table- 1. Comparison of VAS scale between FTT Group and PRE Group

VAS FTTGROUP (N=15)		PRE GROUP (N=15)			t-VALUE
MEAN	S.D	MEAN	S.D		
6.666667	1.046536	6.8	0.676123404	1 DAY	0.326699
4.066667	0.883715	6.066667	0.703732	6 WEEK	2.82137**
1.533333	0.63994	3.6	0.910259	12 WEEK	9.88929**

** Significant < 0.05 level

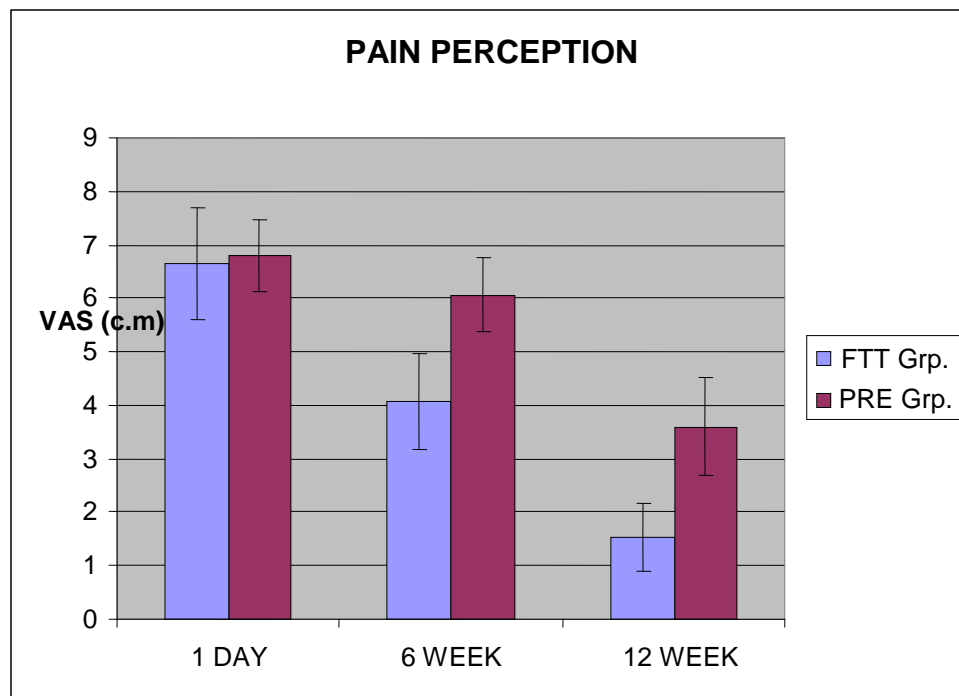


Fig.-1 Comparison of VAS scale between FTT Group and PRE Group

Step Test- Intergroup analysis:- The inter group analysis with respect to the variable step test is reflected in (Table 2., figure 2.). The overall data which was analyzed revealed significant improvement on the effective variable in both the groups. There was an insignificant difference between FTT Group and PRE Group at Day 1 (Pre-Test.) with t value=0.168525, $p < 0.05$. There was insignificant difference between FTT Group and PRE Group at Week 6 (table 2. figure 2.) with t value=0.000447, $p < 0.05$. There was a significant difference between FTT Group and PRE Group at Week 12 (table 2. figure 2.) with t value=2.5854, $p < 0.05$.

Table: 2. Comparison of Step test between FTT Group and PRE Group.

Step test FTT GROUP (N=15)		PRE GROUP (N=15)			t-VALUE
MEAN	S.D	MEAN	S.D		
3.461538	0.518875	3.307692308	0.480384461	1 DAY	0.168525
4.538462	0.518875	3.923077	0.493548	6 WEEK	0.000447
6.615385	0.50637	4.769231	0.438529	12 WEEK	2.5854**

** Significant at <0.05 level

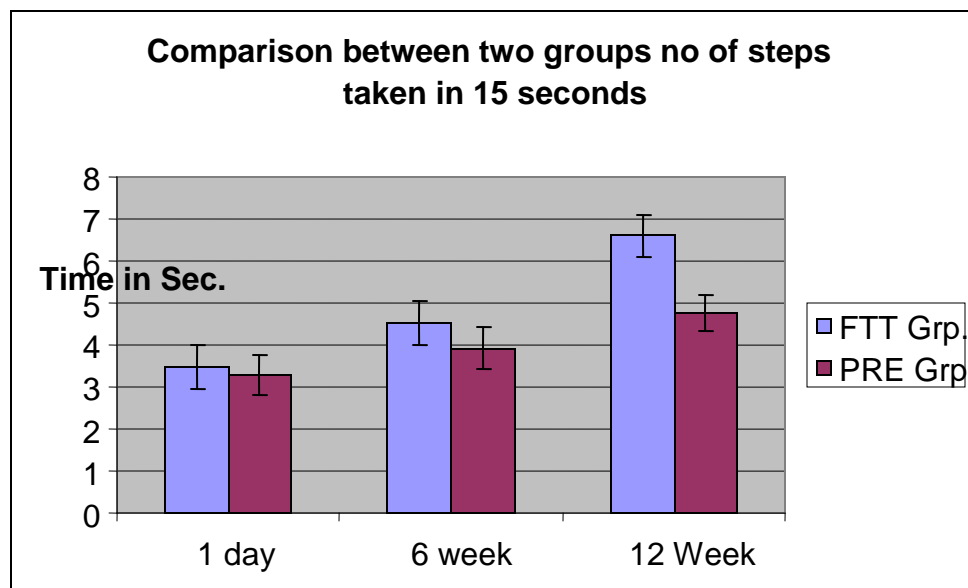


Fig.-2 Comparison of Step Test between FTT Group and PRE Group

Walking speed Test - Intergroup analysis

The intergroup analysis with respect to the variable, **walking speed is reflected in** (table 3. figure 3.). The overall data which was analyzed revealed significant improvement on the effective variable in both the groups. There was an insignificant difference between FTT Group and PRE Group at 1 Day (Pre-Test) with t value=0.145, $p < 0.05$. There was insignificant difference between FTT Group and PRE Group at Week 6 (table 3. figure 3.) with t value=0.02, $p < 0.05$. There was significant difference between FTT Group and PRE Group at Week 12 (table 3. figure 3.) with t value=4.68, $p < 0.05$.

Table: 3. Comparison of Walking speed test between FTT Group and PRE Group.

Walking speed FTT GROUP (N=15)		PRE GROUP (N=15)			t-VALUE
MEAN	S.D	MEAN	S.D		
5.266667	1.032796	5.2	1.082325539	1 DAY	0.375649
4.2	1.014185	4.666667	0.816497	6 WEEK	0.055144
3.133333	0.351866	3.933333	0.703732	12 WEEK	0.001464**

** Insignificant at 0.05 level

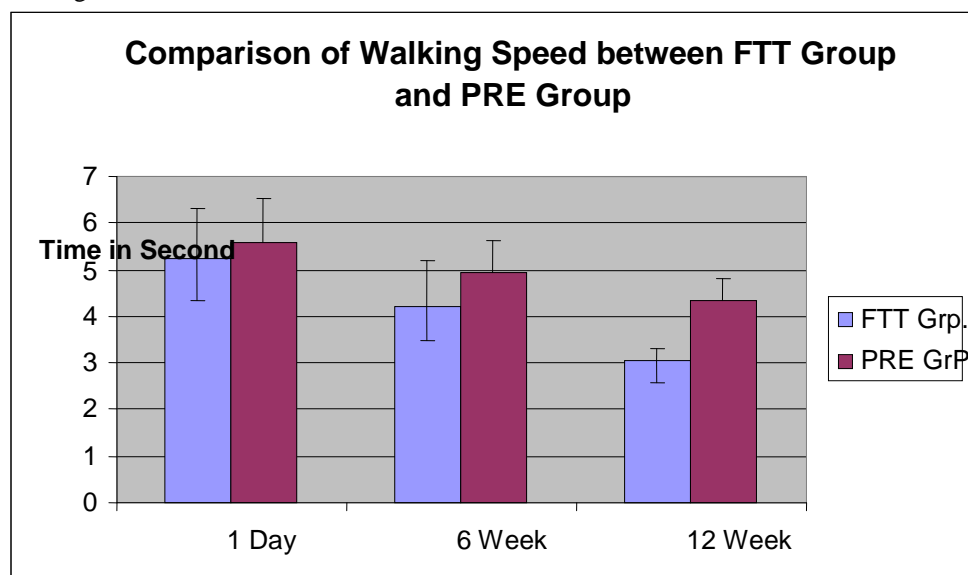


Fig.: 3. Comparison of Walking speed test between FTT Group and PRE Group.**Discussion:-**

In this study, two types of Exercises technique were utilized to examine if any significant differences existed in measurement of pain (as measured by the VAS score), Balance and functional outcomes on Walking speed test & Step test. Results indicate that both groups improved in all measures of pain, Balance and functional outcomes (walking time). However the effect on Pain measured by VAS, walking speed test score & stair climbing test score which was highly significant across the two testing periods (at 6 week & 12 week) for the functional task training group (FTT). This shows that FTT exercise technique gives early and highly significant relief in Pain and provides good balance & functional mobility which display similarity with those reported by Deyle et al.¹² Overall, the results from this study are consistent with those found in the literature and suggest that regardless of group assignment, strengthening exercises decrease pain, stiffness, and improve self-reported function in individuals with knee OA (Deyle et al., 2005; Hinman, Heywood, & Day, 2007; Jamtvedt et al., 2008;).^{12,13,14.}

Singh K K et al.,(2016) reported that Functional task training on regular basis is an effective rehabilitation program for improving functional mobility, balance and decreasing pain and stiffness in OA Knee.¹⁵ McGibbons et.al. (2003) found that a sit to stand task translated to greater forward momentum. Faster rise times noted for the FTT group may indicate improvements in postural stability (Balance) required accommodate to larger changes in the center of gravity associated with this activity. These findings further support the possibility of task-specific training in transfer to task performance.¹⁶ Whitehurst, Johnson, Parker, Brown, and Ford (2005) found similar results in their 12-week study of functional task exercises with an elderly population. The exercises included wall squats, single leg balance, star exercise, modified pushups and walking over obstacles while carrying bags. The environment was varied by obstacle height, changing directions and walking backward. Outcome measures were significant for the get up and go test (TUG), standing reach, sit and reach and self-report of physical function.¹⁷

Sibel eyigor2003 did study on isokinetic against PRE in OA knee patients and found that both programs are equally effective in decreasing pain and improvement in function (walking time) and no statistically significant differences could be found in two groups.¹⁸ Campbell 1982 documented that dynamic stability of the knee joint depends on the appropriate strength ratio of quadriceps and hamstrings.¹⁹ Since greater knee extensor torque and power are required when ascending/descending stairs (Mizner et al., 2005)²⁰ and the FTT group spent more time performing this activity, the noted improvements may be a result of greater power associated with the additional time spent in task performance which is supporting the result of our study.

Conclusion:-

In this study both groups improved in all measures of pain, balance and functional outcomes. However Functional Task training group benefited by significant relief in Pain, achieved good balance & functional mobility than Traditional exercise group. Functional task training is an effective rehabilitation program for improving functional mobility and decreasing pain in OA Knee.

References:-

1. Zhang Y, Jordan JM. Epidemiology of osteoarthritis. *Clinical Geriatric Medicine* 2010; 26: 355–369
2. RACGP Osteoarthritis Working Group. Guideline for the non-surgical management of hip and knee osteoarthritis [cited November 2011]; Available at: Melbourne: Royal Australian College of General Practice (RACGP)
http://www.racgp.org.au/Content/NavigationMenu/ClinicalResources/RACGPGuidelines/Guidelineforthenonsurgicalmanagementofhipandkneeosteoarthritis/RACGP_OA_guideline.pdf; July 2009.
3. Gur H, C, akin N. (2003): Muscle mass, isokinetic torque, and functional capacity in women with osteoarthritis of the knee. *Arch Phys Med Rehabil* 84:1534-41.
4. American Academy of Orthopaedic Surgeons. Clinical Practice Guideline on the Treatment of Osteoarthritis of the Knee (Non-Arthroplasty). Rosemont (IL): American Academy of Orthopaedic Surgeons AAOS; (<http://www.aaos.org/Research/guidelines/OAKguideline.pdf>).
5. Brousseau, L., Wells, G. A., Tugwell, P., Egan, M., Douboulouz, C. J., Casimiro, L., Robinson, V. A., Lamb, M. (2005). **Ottowa** Panel evidence-based osteoarthritis. *Physical Therapy*, 85, 907-971.
6. Stutz-Doyle, C., Pinto Zipp, G., Stiskal, D. & Olson, V. (2009, May). The effects of traditional strengthening exercises versus functional task training on pain, strength and gait in the 45-65 year old adult with knee

- osteoarthritis. Poster session presented at the *American Physical Therapy Association Annual Conference*, Eatontown, N.J.
7. Dauphin AP et al. Bias and Precision in Visual Analogue Scales: A Randomised Controlled Trail. *American Journal of Epidemiology* 1999; 150(10): 1117-1127.
 8. Davies, GJ: A Compendium of isokinetics in clinical Usage, ed 3. S & S Publishers, Onalaska, WI, 1980.
 9. Frankel, V and Nordin, M: Basic Biomechanics of the skeletal System. Lea & Febiger, Philadelphia, 1980.
 10. Tiwari M et al., effects of combined isotonic exercises protocol on unilateral symptomatic Osteoarthritis Knee; *International Journal of Therapies and Rehabilitation Research* 2015; 4 (4): 132-137
 11. Stutz-Doyle, Christine M., "The Effects of Traditional Strengthening Exercises Versus Functional Task Training on Pain, Strength, and Functional Mobility in the 45-65 Year Old Adult with Knee Osteoarthritis" (2011). *Seton Hall University Dissertations and Theses (ETDs)*. Paper 98.
 12. Deyle, G.D., Allison, S.C., & Matekel, R.L., Ryder, M.G., Stang, J.M., Gohdes, D.D., ... Garber, M.B. (2005). Physical therapy treatment effectiveness for osteoarthritis of the knee: a randomized comparison of supervised clinical exercise and manual therapy procedures versus a home exercise program. *Physical Therapy*, 85, 1301 - 1317.
 13. Hinman, R.S., Heywood, S.E., & Day, A.R. (2007). Aquatic physical therapy for hip and knee osteoarthritis: results of a single-blind randomized controlled trial. *Physical Therapy*, 87, 32-43.
 14. Jamtvedt, G., Dahm, T., Christie, A., Rikke, M.H., Haavardsholm, E., Holm, I. & Hagen, K.B. (2008). Physical therapy interventions for patients with osteoarthritis of the knee: an overview of systematic reviews. *Physical Therapy*, 88, 123-126.
 15. Singh K K & Tiwari M. (2016); The effects of traditional strengthening exercises versus functional task training on pain, balance and functional mobility in knee osteoarthritis. *International Journal of Therapies and Rehabilitation Research* 5 (4):250-256.
 16. McGibbon, C. A., Krebs, D.E. & Moxley Scarborough, D. (2003). Rehabilitation effects on compensatory gait mechanics in people with arthritis and strength impairment. *Arthritis & Rheumatism*, 49(2), 248-254.
 17. Whitehurst, M. A., Johnson, B. L., Parker, C. M., & Ford, A. M. (2005). The benefits of a functional exercise circuit for older adults. *Journal of Strength Conditioning Research*, 19(3), 647-651.
 18. Sibel Eyigor et al. Comparative study on efficacy of Isokinetic and Progressive resistive exercise (PRE) programs in patients with knee OA: *Curr Opin Rheumatol*. 2005; 17(5):634-40.
 19. Campbell D E, Glenn W (1982), Rehabilitation of knee flexor and knee extensor muscle strength in patients with menisectomies, ligamentous repairs chondromalacia, *Physical Therapy*, 62, 10-15
 20. Mizner, R. L., & Snyder-Mackler, L. (2005). Altered joint loading and sit-to-stand is affected by quadriceps weakness after total knee arthroplasty. *Journal of Orthopedic Research*, 23(5), 1083- 1090.