PRIMARY OSTEOARTHRITIS OF THE KNEE: COMPARATIVE STUDY BETWEEN ARTHROSCOPIC DEBRIDEMENT AND SUPERVISED MEDICAL TREATMENT FOR THE STAGE (II AND III) OF THE DISEASE

Areewan Mohammed Salih Saeed [a] and Nabaz Muhammed Ali [b]

Submitted: 10/10/2017; Accepted: 17/4/2018; Published 1/8/2018

ABSTRACT

Background

Osteoarthritis is a chronic disorder of synovial joints with progressive softening and disintegration of articular cartilage accompanied by osteophytes, cyst formation, subchondral sclerosis, synovitis and capsular fibrosis, it can be classified into primary and secondary types. Pain is the usual presenting symptom; modalities of treatment includes: physiotherapy, pharmacotherapy and surgery including arthroscopic debridement, osteotomy or arthroplasty.

Objectives

To assess the effect of arthroscopic debridement in stage II & III primary osteoarthritis of the knee joint and to compare that with the supervised medical therapy.

Patients and Methods

This prospective study was carried out between December 2011 and January 2015, 106 patients with 106 primary knee joint osteoarthritis were included. Age range between 30-60 years, mean (50±7.592); male 43 (40.56%), female 63 (59.43%); male to female ratio was (1:1.45); body mass index (25.50-34.00) mean (29.6375), the right side affected in (48.2%) and left side in (51.8%). The cases were divided into two groups; operative and non-operative group randomly, arthroscopic debridement with lavage in fifty-six patients and supervised medical treatment in fifty patients. Modified WOMAC score were used to evaluate both groups in pre-treatment, one week, one month, 3 months, 6 months and one year after treatment.

Results

In the comparison between the two groups, statistically significant differences were observed at the period of 6 months of treatment while no significant difference observed at the end of one year. Patients assigned to arthroscopic surgery have more improvement in the modified WOMAC score than those assigned to medical treatment.

Conclusion

Arthroscopic debridement, lavage and irrigation is more promising in decreasing pain, stiffness, and improving physical function more than supervised conservative therapy in patients with grade II & III primary osteoarthritis of the knee joint six to twelve months after the procedure.

Keywords: *Osteoarthritis, Arthroscopy, Debridement and lavage, Meniscectomy, Subchondral bone penetration.*

[a] Department of Surgery, College of Medicine, University of Sulaimani.
[b] Department of Surgery, Kalar Hospital, Ministory of Health, Sulaimani, Iraq.
Correspondence: nabaz_muhammad@yahoo.com

https://doi.org/10.17656/jsmc.10153

INTRODUCTION

Osteoarthritis is a chronic disorder of synovial joints with progressive softening and disintegration of articular cartilage accompanied by formation of osteophytes, subchondral cyst, sclerosis, synovitis and capsular fibrosis [1]. It may be primary osteoarthritis or secondary osteoarthritis in which the articular cartilage may be damaged by trauma or previous inflammatory disorders [2].

Pain is the usual presenting symptom with stiffness, deformity and loss of function clinically; swelling, crepitus and instability present depending on the stage of the disease [3]. Plain radiography in standing position confirms the diagnosis and help in staging the disease by applying the Kellgren and Lawrence staging system[4].

Table 1. The staging of knee osteoarthritis after Kellgren and Lawrence on plain radiography

Stage 0	No abnormality
Stage 1	Incipient osteoarthritis, beginning of osteophyte formation on eminences
Stage 2	Definite osteophytes and possible joint space narrowing on anteroposterior weight-bearing radiograph
Stage 3	>50% joint space narrowing, rounded femoral condyle, extensive subchondral sclerosis, extensive osteophyte formation, possible bony deformity
Stage 4	Joint destruction, obliterated joint space, subchondral cysts in the tibial and femoral condyle, subluxed position, definite bony deformity

Treatment aimed at relieving patient's pain and improving the physical functions, it includes physical therapy, unloading the joint (avoiding harmful activities, using brace and walking aids), pharmacotherapy, intra-articular injection of corticosteroids and hyaluronic acid [5].

Surgery is needed in most of the cases due to the progressive nature of the disease, including arthroscopic debridement, osteochondral or chondrocyte transplantation, osteotomies, unicompartmental or total knee arthroplasty and arthrodesis as a salvage operation for failed total knee arthroplasty. Arthroscopic surgery includes washouts of chemical mediators that induce pain and promote joint destruction, resection of mobile portions of degenerative menisci, resection of excessive synovial fronds, shaving of severe chondromalacic changes, removal of loose bodies with or without superficial abrasion, drilling, or micro fracture techniques [5].

PATIENTS AND METHODS

This prospective study was carried out in Sulaimani Teaching Hospital, Shar Teaching Hospital and Roonaky Hospital from the period between December 2011 and January 2015 in which 106 patients with primary knee joint osteoarthritis were studied and evaluated; Detailed history taken and thorough clinical examination performed, written informed consent taken from all, discussing in detail both the surgical procedure and the modalities of conservative treatments and approval taken from the ethical committee.

Complete blood count (CBC), erythrocyte sedimentation rate (ESR) and C- reactive protein (CRP) were performed for all patients. Radiographs including standard weight bearing anteroposterior, lateral and axial views of the patella were performed. All patients had Magnetic resonance imaging (MRI) of the affected knee to assess the state of the menisci and exclude possible ligament injury.

Patients are selected according to inclusion and exclusion criteria:

Inclusion criteria:

- Primary osteoarthritis of the knee.
- Age 40-70 years.
- Stage II and III Kellgren-Lawrence (KL)(5). Table 1

Exclusion criteria:

- Advanced stage of osteoarthritis, grade IV.
- Previous history of intraarticular and periarticular fractures.
- Previous history of intra articular steroid and hyaluronic acid injections.
- More than10° Varus deformity.
- Instability.
- BMI ≥30.
- Locked knee.

Patients were divided into two groups (operative and non operative) randomly according to their presentation for clinical consultation and agreement to undergo operative treatment.

Operative group: Includes 56 patients for whom arthroscopic debridement and lavage are performed.

Operative Treatment: Under general anesthesia or spinal anesthesia, intravenous 1gm of third generation

cephalosporin administered, pneumatic tourniquet on the thigh and side support on the edge of the operating table, standard disinfection using povidone iodine solution applied followed by surgical draping. Arthroscopy performed through standard (anterolateral and anteromedial) portals, using 30° inclination lens, routine examination of the knee done.

Debridement (partial meniscectomy, limited synovectomy, shaving and abrasions of degenerated articular cartilage, microfracture of exposed subchondral bone, removal of loose bodies) and washout by normal saline were done. Portal skin sutured and dressing applied, an ice pack around the knee was used to decrease swelling, analgesia like (paracetamol tablet 500 mg or meloxicam tablet 15 mg) according to patient's need, second dose of intravenous antibiotics given 8 hours postoperatively. First day physiotherapy started (quadriceps and hamstring strengthening exercise with range of motion exercise) then partial weight bearing with crutches in the second day till the seventh day. Full weight bearing without crutches started 7th days after operation; activity modification and body weight reductions were advised.

Non-operative group included 50 patients for whom standard conservative therapy was performed.

Non-operative treatment:

1. Oral analgesics (paracetamol) and non-steroidal anti-inflammatory drugs (selective COX2 inhibitors).
2. No disease modifying drugs (glucosamine, chondroitin, intraarticular hyaluronic acid) or steroid injections was used.
3. Physiotherapy (muscle strengthening exercise, ice packs, ultrasound, TENS, stretching exercises).
4. Harmful activity modification.
5. Walking aids.
6. Orthotics.
7. Body weight reduction was advised.

Knee assessment was performed using WOMAC score system (Western Ontario and McMaster Universities Osteoarthritis Index). It has three subscales pain (5 items), stiffness (2 items) and physical function (17 items). Each item is assessed on a scale of 0-4, 0 being the best and 4 is the worst, total scores range from 0 to 96; higher scores indicate increased pain, stiffness, and decreased physical function. We did modification by adding knee range of motion scores (0 = more than 120°, 1 = 110°-120°, 2 = 100°-110°, 3 = 90°-100°, 4 = less than 90°), so the total score will range from 0-100. [6].

Baseline modified WOMAC score was performed before treatment for all patients and rechecking in one week, one month, 3 months, 6 months and one year after treatment were done.

Baseline characteristics, total modified WOMAC score and its subscales were analyzed by descriptive statistics (SPSS version 16.0) for windows XP. For analysis, the total modified WOMAC score at different intervals were compared between the two groups with the use of analysis of compare means (independent-sample T test). An independent-sample T test P value of ≤ 0.05 was considered to indicate statistical significance.

RESULTS

The study sample includes 106 patients, 63 female 43 male with F: M ratio of 1.4:1; ages ranged between 40-70 years mean 57.67, the basic demographic data of the patients are summarized in Table1.

Pain was the main presenting symptoms especially activity related and night pain, the rest of symptoms are listed in Table 2.

Plain radiograph of the patients shows 62.26% having stage III disease and MRI reveals medial meniscal tear in 70.75% Figure 1 and 2.

Table 1. The demographic data of the studied patients.

		Frequency	Percent
Patients gender	*Male*	43	40.56
	Female	63	59.43
Patients age	*Range*	40-70	
	Mean	57.67	
Patients BMI	*Range*	20.50-29.60	
	Mean	25.05	

Table 2. Frequency and percentage of patient's symptoms and signs.

		Frequency	Percent
Pain on activity	Positive	106	100.0
	Negative	0	0
Night pain	Positive	106	100.0
	Negative	0	0
Catching sensation	Positive	69	65.09
	Negative	37	34.90
Swelling	Positive	78	73.58
	Negative	28	26.41
McMurray's test	Positive	64	60.3
	Negative	42	39.62
Degree of flexion	< 110°	60	56.60
	>110°	46	43.39

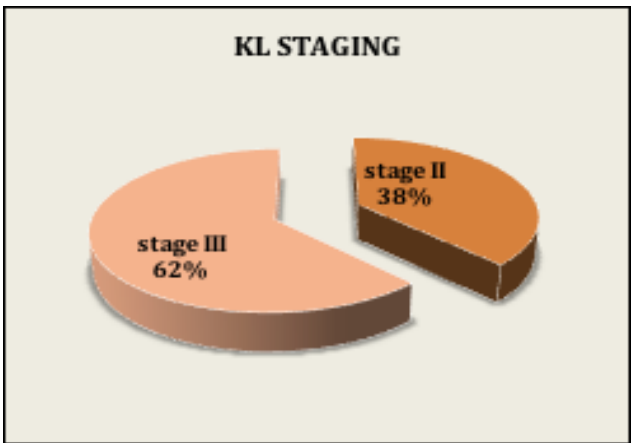

Figure 1. Distribution of patients according to KL radiological grading.

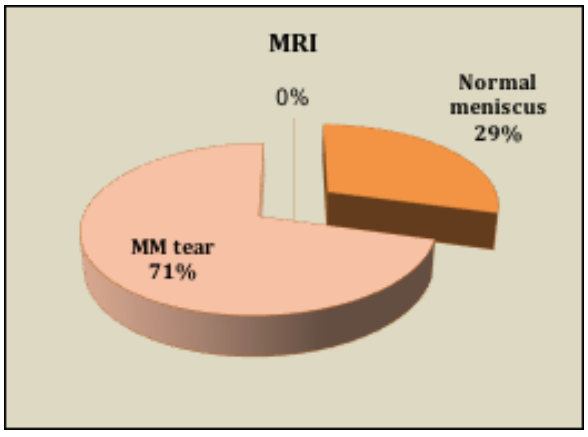

Figure 2. Distribution of patients according to MRI findings.

Operative group included 56 patients, their data shown in Table 3.

The mean modified WOMAC score of the operative cases was (77.07±3.129) pre-operatively, significantly dropped to (47.50±2.091) at the end of 6 months with P-value (0.001), to rise again to (68.95±0.51) one year post operatively with P-value (0.07), Figure 3

The mean pain score is mainly changed in the modified WOMAC score, pre-operatively (11.77±1.073) and dropped to (5.97±0.669) 6 months after operation with P-value (0.04) to rise again to (10.55± 0.31) one year after operation, with P-value (0.062), Figure 4.

Mean stiffness score was (4.67±0.844) pre-operatively and dropped to (3.20±0.484) 6 months after operation with P-value (0.004) to rise again to (4.22±0.54) one year after the operation with P-value (0.07), Figure 5.

The mean physical function scores improved from (61.02±0.35) preoperatively to (38.11±0.23) at the end of six months with P –value (0.002) and elevated again at one year to (55.71±0.21) with P –value of (0.08), Figure 6.

Mean knee flexion scores also improved, from (3.60±0.675) pre-operatively to (2.00±0.455) 6 months, but with slight elevation to (2.22±0.31) at one year after operation with P-value (0.001), Figure 7.

Figure 7 shows the difference in the mean knee flexion score of operative group

The improvement of the mean WOMAC score was more in the subgroup of the operative patients having meniscal tear and for which partial meniscectomy done (77.6±0.12 to 39.23±0.80 at 6 months and 57.61±0.32 after one year) with p- value of 0.004 than those without meniscal tear (76.5±0.11 to 55.65±0.32 at 6 months and 80.10±0.45 after one year) with p- values of 0.06, Figure 8.

Table 3. Frequency and percentage of patient's demographic data, symptoms and signs of operative group.

		Frequency	Percent
Gender	Male	21	37.5
	Female	35	62.5
Age	40-49	6	10.71
	50-59	35	62.5
	60-70	15	26.7
Pain on activity	Positive	56	100.0
	Negative	0	0
Night pain	Positive	56	100.0
	Negative	0	0
Catching	Positive	30	53.57
	Negative	26	46.42
McMurray's test	Positive	40	71.42
	Negative	16	28.57
Knee flexion in degrees	Range	90°-130°	
	Mean	102.83°	
MRI	Normal	9	16.07
	MM tear	47	93.92

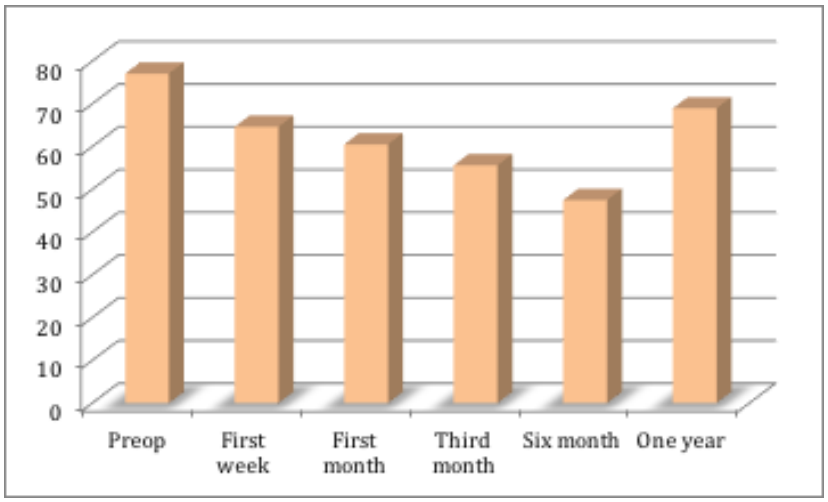

Figure 3. Difference in the modified WOMAC score in the operative group.

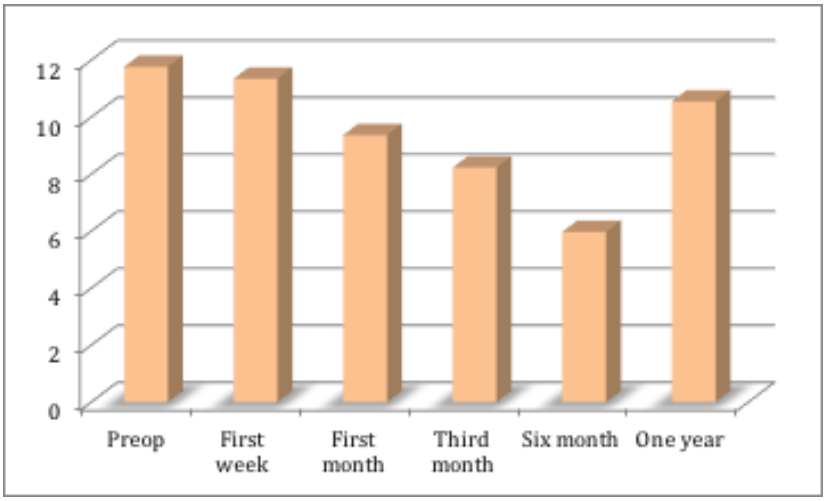

Figure 4. Difference in the mean pain score of operative group.

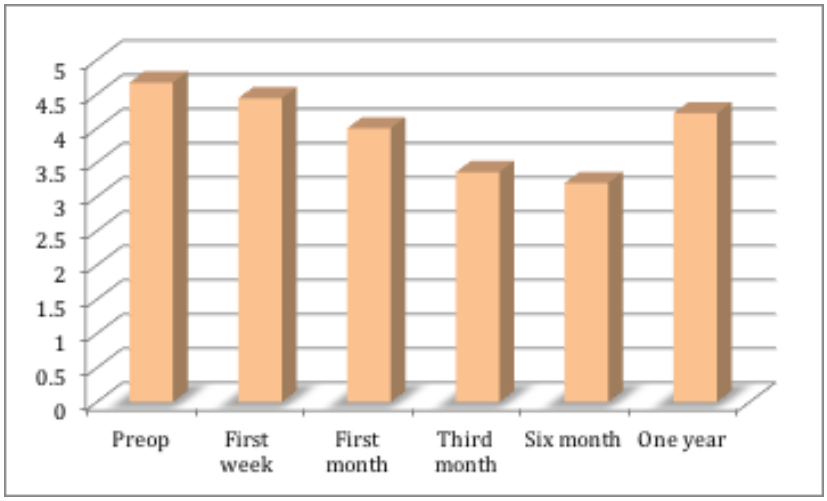

Figure 5. Difference in the mean stiffness score of operative group.

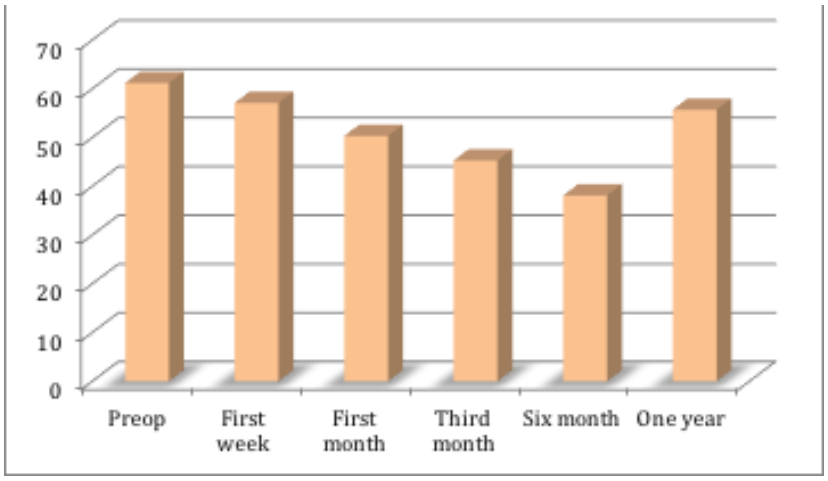

Figure 6. Difference in the mean physical function score of operative group.

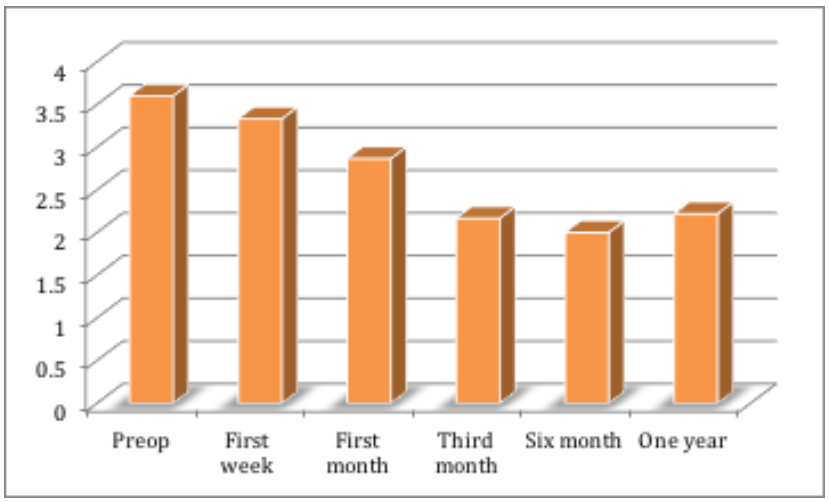

Figure 7. Difference in the mean knee flexion score of operative group.

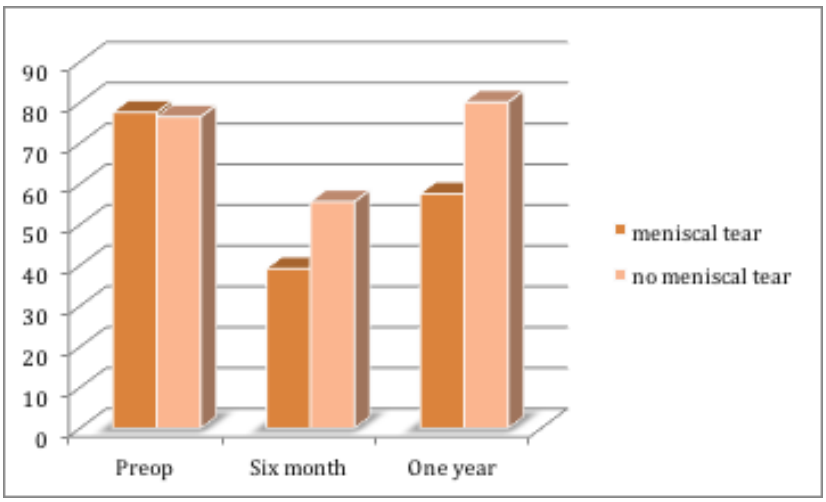

Figure 8. Difference in the mean WOMAC score between patients with meniscal tear and those without.

Non-operative group: Includes 50 patients, their data shown in Table 4.The mean modified WOMAC score of the non-operative cases was (74.23±2.861) pre-treatment improving in the first month to (50.50±2.005) P-value (0.002), but slowly deteriorated afterwards to (67.55±3.382) 6 month and (75.44±2.1) one year after treatment with P-value (0.062), Figure 9.

The mean pain score was significantly improved in the first week of treatment (11.46±0.989) to (7.88±0.67) with P-values of (0.004), but started to deteriorate with time to reach (11.08±1.197) six months and (12.1±0.831) one year after treatment P-value (0.065), Figure 10.

Figure 10 shows the difference in the mean pain score of non-operative group.

Mean stiffness score was (6.12±0.952) pre- treatment and (6.5±0.736) one year after treatment with P-value (0.067), Figure 11.

The mean scores for physical function decreased significantly in the first month of treatments from 63.4±0.54 to 45.7±0.44 with P-value of (0.02) to rise again gradually reaching (60.22±0.11 and 64.8±0.56) six month and one year post treatment respectively with P-values of (0.33), Figure 12.

There was no significant improvement in the mean knee flexion scores, pre-treatment (3.58±0.758), 6 months after treatment (3.57±0.643) and one year after treatment (3.60±0.532) P-value (0.381), Figure 13).

When comparing the total WOMAC Scores of operative and conservatively treated groups, there is statistically significant difference between the two groups at 6-month period (47.50±2.091 and 67.55±3.382) with p-values of (0.003), while when comparing the total scores at one year period no statistical difference found (68.95±0.51 and 75.44±2.1) with p- values of (0.07) figure, Figure 14.

When comparing the total WOMAC Scores of the subgroup of patients with degenerative meniscal tear treated operatively and conservatively, statistically significant difference found at six months (39.23±0.80 and 58.13±0.61) with p-values of (0.05) and one year (57.61±0.32 and 70.3±0.64) with p-values of (0.04), Figure 15.

When comparing the pain sub score between the two groups statistically significant difference found at six months (5.97±0.669 and11.08±1.197) with p-values of (0.05) while no significant difference at one year (10.55± 0.31 and 12.1±0.831) with p- values of (0.06), Figure 16.

When comparing the physical function sub score between the two groups statistically significant difference observed six months after treatment (38.11±0.23 and 60.22±0.11) respectively with P-values of (0.04) while no significant difference at one year (55.71±0.21 and 64.8±0.56) with p-values of (0.06), Figure 17.

When comparing the knee flexion sub score between the two groups statistically significant changes observed at one year (2.22±0.31 and 3.60±0.532) with P-value of (0.053), Figure 18.

Table 4. Frequency and percentage of patient's demographic data, symptoms and signs of non-operative cases.

		Frequency	Percent
Gender	Male	22	44
	Female	28	56
Age	40-49	14	28
	50-59	23	46
	60-70	13	26
Pain on activity	Positive	50	100.0
	Negative	0	0
Night pain	Positive	50	100.0
	Negative	0	0
Catching	Positive	21	42
	Negative	29	58
McMurray's test	Positive	21	42
	Negative	29	58
Knee flexion	Range	90°-130°	
	Mean	107.7	
MRI	Normal	31	62
	MM tear	19	38

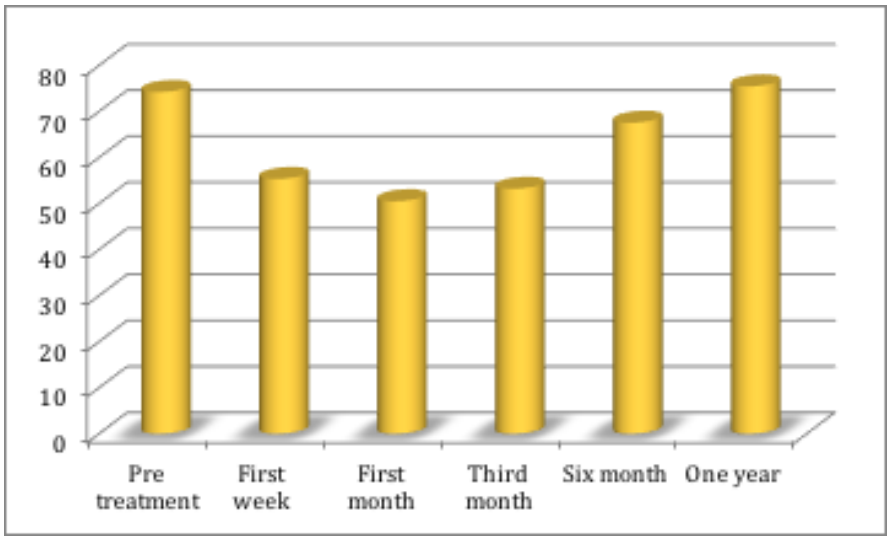

Figure 9. Difference in mean modified WOMAC score of non-operative group.

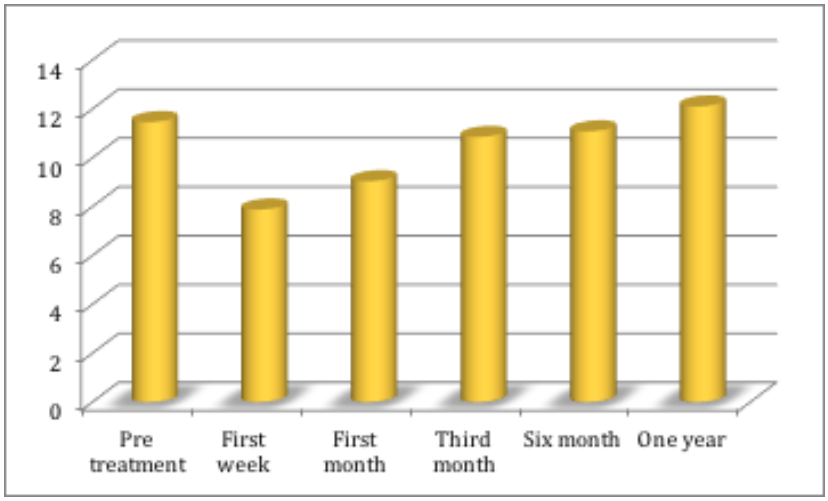

Figure 10. Difference in the mean pain score of non-operative group.

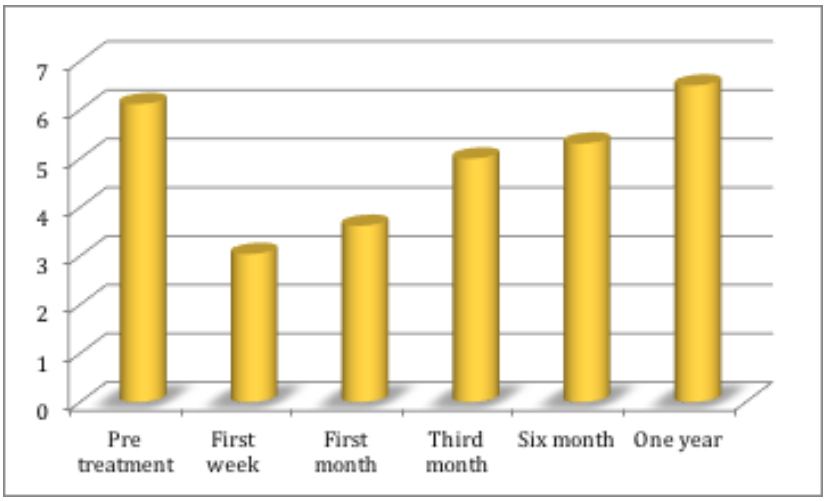

Figure 11. Difference in the mean stiffness score of non-operative group.

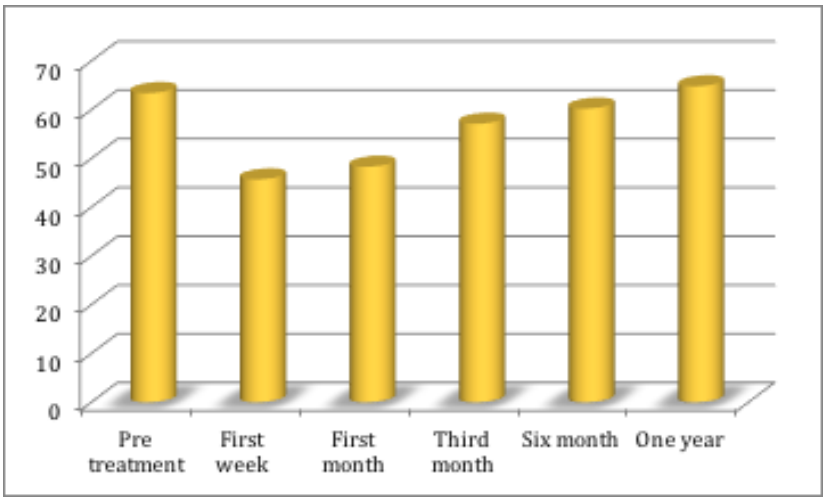

Figure 12. Difference in the mean physical function score of non-operative group.

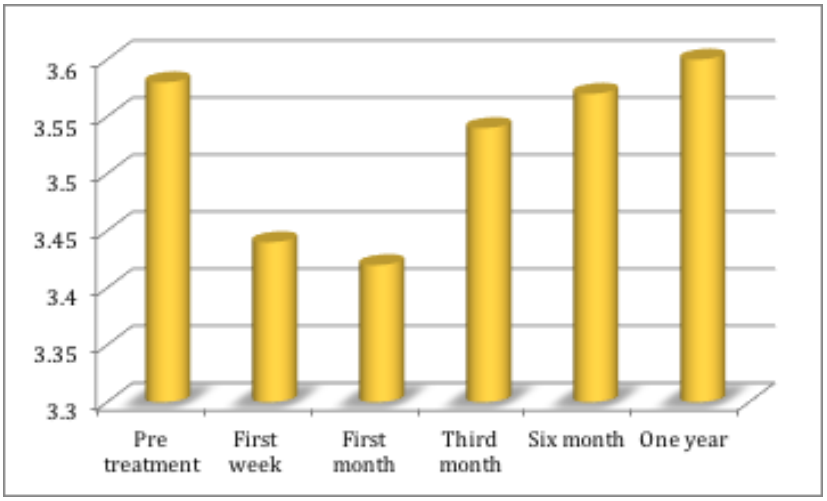

Figure 13. Difference in the mean knee flexion score of non-operative group.

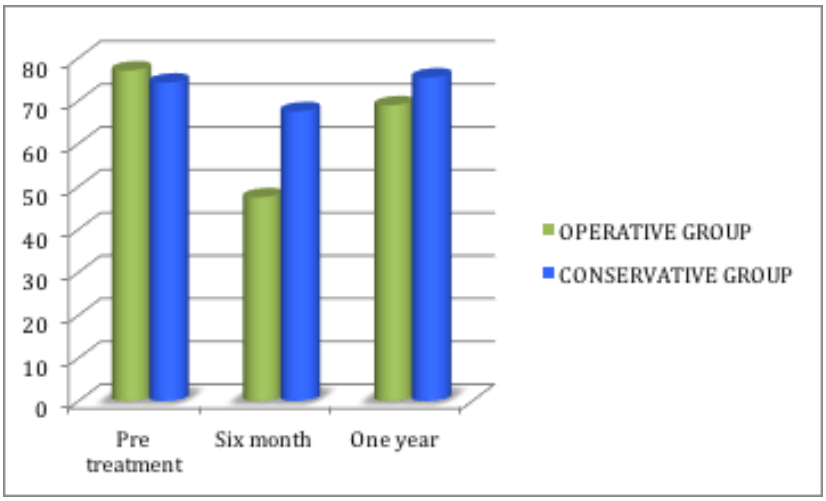

Figure 14. Difference in total modified WOMAC score between the two groups.

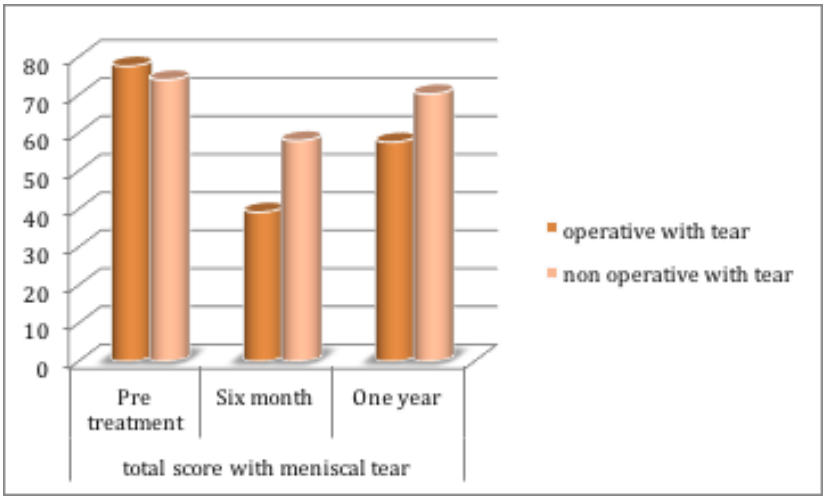

Figure 15. Difference in total modified WOMAC score in the subgroup of patients with degenerative meniscal tear treated by the two methods.

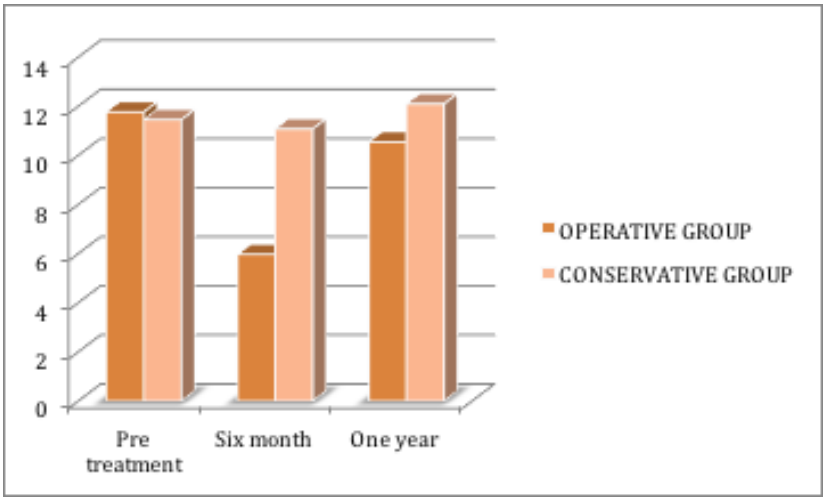

Figure 16. Difference in the pain sub score between the two groups.

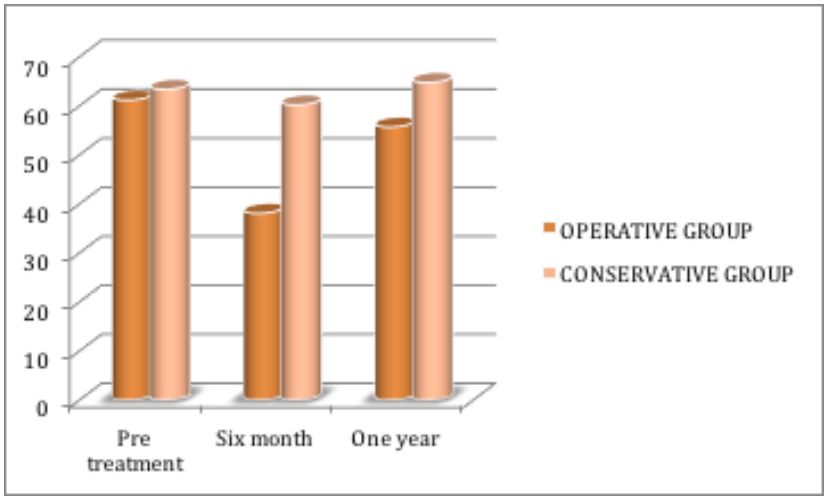

Figure 17. Difference in the physical function sub score between the two groups.

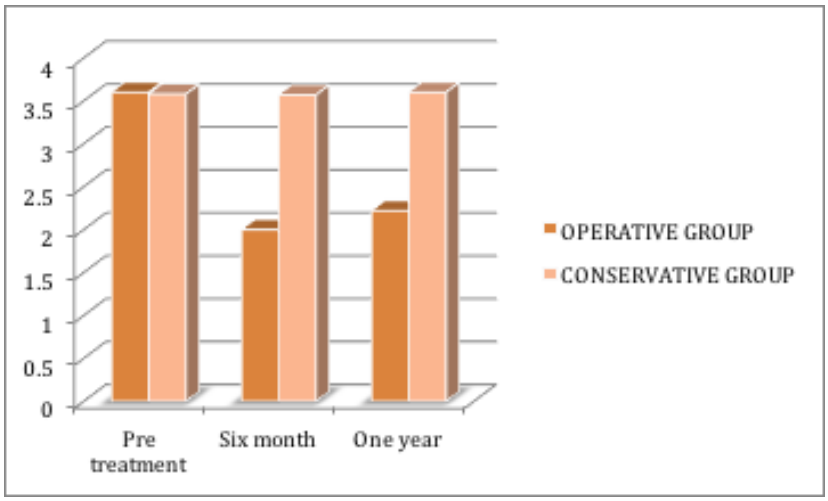

Figure 18. Difference in the knee flexion sub score between the two groups.

DISCUSSION

Degenerative arthritis is one of the most frequent disorders in elderly patients. Knee osteoarthritis is more likely to result in disability than OA of any other joints [7].

Most of the symptoms of OA of the knee are due to the effects of loose fragments of articular cartilage, debris, denuding of subchondral bone, degenerative tears of the menisci, loose bodies, osteophyte formation, synovitis and effusion[8].

The precursors to modern arthroscopic surgery appeared as early as 1912, when Danish surgeon and radiologist Severin Nordentoft first described endoscopic visualization of the knee joint [9]. In 1934 Burman et al. advocated joint lavage as a treatment option in painful arthritic knees [10]. Karaman et al in his retrospective study on 80 patients conclude that arthroscopic joint debridement increases the activity level of patients with moderate knee osteoarthritis in short- and mid-term follow-up [11]. Forster and Casscells stated that there was an improved activity period exceeding two years in the washing and debridement group in their studies [12, 13].

The aim in this study was to compare two lines of treatment in the stage II and III of primary knee osteoarthritis and to study the effectiveness of either modality in relieving patients pain and improving physical function within the first year after treatments.

This study reveals female to be affected more than male in both operative and non-operative groups (1.4:1); this is comparable to studies done by Shannon et. al [10], Karaman et. al [11] and Lyu et. al [14].This is because various anatomical and constitutional factors make primary osteoarthritis commoner in female.

Patients with body mass index more than 30 were excluded; this is because more obese patients have poor response to either way of treatments giving improper assessment of outcome, this is in agreement with Kirkley. et al [15], Chung Shik Shin et. al. [16].

Patients receiving intra articular steroids or hyaluronic acid injections are excluded since the use of these medications preoperatively and especially after the operation will mask the effect of arthroscopic intervention in osteoarthritis, steroids having anti-inflammatory effects and hyaluronic acid will provide a lubricant effect giving a false sense of improvement which is not the scope of this study.

The significant improvement in pain and physical functions that's observed in the operative group at 6 months are due to the fact that arthroscopy provide both biochemical and mechanical benefit by removing friable articular cartilage, degenerated meniscus and removing the cytokines and other mediators that produce pain and cause progressive cartilage wear and degeneration. Sokolove J. reviewed a wide range of mediators involved in OA onset and progression, he described Damage Associated Molecular Patterns (DAMPs) including {cartilage extracellular matrix components, plasma proteins (α1-microglobulin, α2-macroglobulin), intracellular alarmins, crystals, fibroblast-like syoviocytes and chondrocytes which releases chondrolytic mediators (TNFA, IL-1β, matrix metalloproteinase, IL-6 and IL-8)}, [17]. By removing these mediators and cells there will be noticeable decrease in pain and improvement in function, but no proof till now that progression of the disease is slowed down.

The same improvement is observed by Shannon et. al and Karaman et. al who also observed significant improvement in knee scores at 6 months after operation. [10, 11].

Still with this improvement the mean score rise up again after one year to reach values near the preoperative state, the explanation is that osteoarthritis is a progressive disease and till now no any treatment modality is known to stop disease progression, this is not comparable with Jackson et al whom in a randomized study reported on 137 patients treated with lavage and debridement, 88% showed initial improvement; 68% maintained their improvement at3-year follow-up [18].

Shannon et. al and Karaman et. al also observed improvement up to 24-36 months, the explanation of that is their inclusion of milder degree disease, use of viscosupplimentation post operatively and better patient compliance with the postoperative advises on daily activities [10, 11].

The mean modified WOMAC score of non-operative group was improved significantly one month after starting treatment then after that deteriorate in all other visits; the explanation is the fact that medical therapy gives a short term symptomatic relief but has no any role in changing the mechanical and biochemical factors that are responsible for the patients symptoms; this is not comparable to Kirkley. et al who achieved improvement in the total WOMAC score of control group up to 3 months after treatment [15]. This is because

they add to the treatment hyaluronic acid injections to the knee and this may be the cause of relieving mechanical symptoms. Since most of the patients in this study has catching and features of meniscal tear this may explain why patients have shorter-term clinical response with conservative therapy, patient compliance to conservative therapy may be another reason.

If comparing the changes in the mean modified WOMAC score of the two groups at 6 and 12 months, significant changes observed at 6 months, more improvement in the operative group while the values are not significantly different after one year although operative patients still have better values, this could be explained by the fact that debridement and lavage greatly influence the degenerative process by removing the chondro destructive mediators for months; then after that degenerative process keep on progressing in most of the patients despite all modalities of treatment.

Pain was the main subscale to improve at 6 months after surgery, although initially pain improves more in the conservative cases but afterwards it starts to deteriorate again probably due to the initial effect of the medical treatments, the explanation is that by debridement we can deal with the mechanical causes of pain (loose flaps of articular cartilage, meniscal tears, loose bodies and inflamed synonium) and remove the biological mediators of pain from the synovial fluid.

Although the pain scale start to rise up at one year, still the operative group experience less pain than the non-operative group.

Xinning Li et. al [19], Chung Shik Shin et. al [16] and Michael J. Stuart et. al [20], all achieved the same improvement of pain at six months postoperatively, but Kirkley. et al and Sedeek MS et al, observed that the reduction of pain last not more than three months [15, 21].

Another significant observation is the better pain improvement in the subgroup of patients having symptomatic degenerative meniscal tear which last even one year after operation, this fact may encourage performing more operations when osteoarthritis associated with symptomatic degenerative meniscal tears, Felson DT in his literature review end with the same conclusion [22]. Kise NJ et al in a randomized controlled trial end with a conclusion that no arthroscopic surgery should be performed for degenerative meniscal tear, this controversy is because they include patients with no radiological features of osteoarthritis and they give the final result two years after surgery in which most patients they have recurrence of symptoms [23].

Joint stiffness and physical functions are improved more in the operative group at 6 months although they deteriorate again at one year; the explanation is the decrease in the severity of the knee pain, the removal of mechanical obstacles and inflammatory mediators inside the joint, which facilitate this improvement.

The observations in this study revealed significant improvement in the range of knee movement when arthroscopic intervention performed and this last even one year after intervention; pain relief and improved physical function explained that since they facilitate more activity and better chance of performing physical therapy.

J. Bruce Moseley [24], Jeffrey N. Katz [25], all agree that the result of arthroscopic debridement with partial meniscectomy is not superior to placebo or conservative physical therapy at long term follow up, this is comparable to this study since operative patients has a better pain relief and improved physical activities only during the first year after operation then after that the improvement is less and most of the patients start to have recurrence of their preoperative symptoms.

Most of the patients deteriorate with time, the explanation of that is the fact that arthroscopic debridement is not a procedure aiming at cure and osteoarthritis is a progressive degenerative disease, till now no any modality of treatment is known to stop the disease progression.

No any patient in this study developed complications especially deep vein thrombosis and infection and a part from risk of anesthesia and operations it could be regarded as a relatively safe procedure.

In conclusion: although a lot of controversy rises in the last ten years about the role of arthroscopy in knee osteoarthritis, this study provides evidence that arthroscopic debridement, lavage with irrigation is more promising than supervised medical treatment in improving knee pain, stiffness, physical function and knee range of motion for six to twelve months after the procedure, especially in the subgroup of patients with symptomatic degenerative meniscal tear and evident radiological grade II and III osteoarthritis when limited partial meniscectomy performed; but with time this improvement deteriorate and most patients after one year regain some if not all the preoperative symptoms.

There are no any direct or indirect financial conflicts of interest to disclose.

REFERENCES

1. Michael JW, Schluter-Brust KU, Eysel P. The epidemiology, etiology, diagnosis, and treatment of osteoarthritis of the knee. Dtsch Arztebl Int Mar;107(9):152-62.

2. Li G, Yin J, Gao J, Cheng TS, Pavlos NJ, Zhang C, et al. Subchondral bone in osteoarthritis: insight into risk factors and microstructural changes. Arthritis Res Ther;15(6):223.

3. Lane NE, Schnitzer TJ, Birbara CA, Mokhtarani M, Shelton DL, Smith MD, et al. Tanezumab for the treatment of pain from osteoarthritis of the knee. N Engl J Med Oct 14;363(16):1521-31.

4. Kijowski R, Blankenbaker D, Stanton P, Fine J, De Smet A. Arthroscopic validation of radiographic grading scales of osteoarthritis of the tibiofemoral joint. AJR Am J Roentgenol2006 Sep;187(3):794-9.

5. Ronn K, Reischl N, Gautier E, Jacobi M. Current surgical treatment of knee osteoarthritis. Arthritis;2011:454873.

6. Woolacott NF, Corbett MS, Rice SJ. The use and reporting of WOMAC in the assessment of the benefit of physical therapies for the pain of osteoarthritis of the knee: findings from a systematic review of clinical trials. Rheumatology (Oxford) Aug;51(8):1440-6.

7. Heidari B. Knee osteoarthritis prevalence, risk factors, pathogenesis and features: Part I. Caspian J Intern Med Spring;2(2):205-12.

8. Siemieniuk RAC, Harris IA, Agoritsas T, Poolman RW, Brignardello-Petersen R, Van de Velde S, et al. Arthroscopic surgery for degenerative knee arthritis and meniscal tears: a clinical practice guideline. BMJ May 10;357:j1982.

9. Katz JN, Brownlee SA, Jones MH. The role of arthroscopy in the management of knee osteoarthritis. Best Pract Res Clin Rheumatol Feb;28(1):143-56.

10. Shannon FJ, Devitt AT, Poynton AR, Fitzpatrick P, Walsh MG. Short-term benefit of arthroscopic washout in degenerative arthritis of the knee. Int Orthop2001;25(4):242-5.

11. Karaman I GA, Kafadar IH, Oner M, Yurdakul E, Turk CY. The Effects of Arthroscopic Joint Debridement in Knee Osteoarthritis Patients Over the Age of Sixty. Erciyes Tıp Dergisi/Erciyes Medical Journal2013;35(3):120-2.

12. Forster MC, Straw R. A prospective randomised trial comparing intra-articular Hyalgan injection and arthroscopic washout for knee osteoarthritis. Knee2003 Sep;10(3):291-3.

13. Casscells SW. What, if any, are the indications for arthroscopic debridement of the osteoarthritic knee? Arthroscopy1990;6(3):169-70.

14. Lyu SR, Hsu CC, Lin CW. Arthroscopic cartilage regeneration facilitating procedure for osteoarthritic knee. BMC Musculoskelet Disord Nov 21;13:226.

15. Kirkley A, Birmingham TB, Litchfield RB, Giffin JR, Willits KR, Wong CJ, et al. A randomized trial of arthroscopic surgery for osteoarthritis of the knee. N Engl J Med2008 Sep 11;359(11):1097-107.

16. Shin CS, Lee JH. Arthroscopic treatment for osteoarthritic knee. Knee Surg Relat Res Dec;24(4):187-92.

17. Sokolove J, Lepus CM. Role of inflammation in the pathogenesis of osteoarthritis: latest findings and interpretations. Ther Adv Musculoskelet Dis Apr;5(2):77-94.

18. Jackson RW, Marans HJ, Silver RS. The arthroscopic treatment of degenerative arthritis of the knee. J Bone Joint Surg Br1988;70:332.

19. Xinning LS, A.Franklin,P.Merolli,R. Arthroscopic debridement of the osteoarthritic knee combined with hyaluronic acid (Orthovisc®) treatment: A case series and review of the literature. Journal of Orthopaedic Surgery and Research2008;4(43).

20. Stuart MJ, Lubowitz JH. What, if any, are the indications for arthroscopic debridement of the osteoarthritic knee? Arthroscopy2006 Mar;22(3):238-9.

21. Sedeek SD, AM.Ibrahim,MY. Osteoarthritis of the Knee: Is any Role for Arthroscopy in the Treatment? Current Review. Journal of Current Surgery2014;4(1):1-5.

22. Felson DT. Arthroscopy as a Treatment for Knee Osteoarthritis. Best practice & research Clinical rheumatology2010;24(1):47.

23. Kise NJ, Risberg MA, Stensrud S, Ranstam J, Engebretsen L, Roos EM. Exercise therapy versus arthroscopic partial meniscectomy for degenerative meniscal tear in middle aged patients: randomised controlled trial with two year follow-up. BMJ Jul 20;354:i3740.

24. Moseley JB, O'Malley K, Petersen NJ, Menke TJ, Brody BA, Kuykendall DH, et al. A controlled trial of arthroscopic surgery for osteoarthritis of the knee. N Engl J Med2002 Jul 11;347(2):81-8.

25. Katz JN, Brophy RH, Chaisson CE, de Chaves L, Cole BJ, Dahm DL, et al. Surgery versus physical therapy for a meniscal tear and osteoarthritis. N Engl J Med May 02;368(18):1675-84.