

A comparative clinical study of intra articular injection of steroid, sodium hyaluronate and platelet rich plasma in osteoarthritis of knee

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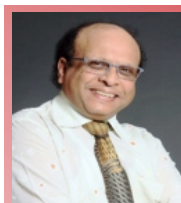
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Abstract

Background: In the treatment of moderate osteoarthritis with intraarticular injection there are many available options as steroid, hyaluronic acid and platelet rich plasma. But there are lack specific clear-cut indications. Our study is intended to compare result of different injections and correlate it to find some specific indication

Method: Total 209 knees of 124 patients studied in three groups, one group had steroid, and second group had hyaluronic acid and third had platelet rich plasma. For clinical evaluation knee society score and visual analogue scale score were used.

Results: In my study steroid gives shortest post injection pain relief only for few weeks. Hyaluronic acid gives pain relief for few months and is better for older patients with higher grade of OA. PRP gives pain relief for months and better result in younger patient with lower grade of OA.

Conclusions: It is not a curative treatment but only short term solution for chronic knee pain. Steroid was cheap and effective for short duration, can be used for acute exacerbation. Hyaluronic acid was better in older and degenerated joint while PRP was good in younger patients with lower grade of degeneration.

Keywords: Osteoarthritis, intraarticular, steroid, viscosupplement, platelet rich plasma.

Thesis question : In front of clinicians there are many choices available for intraarticular injections for knee osteoarthritis (OA) with no established clear guideline for a particular injection. We have done an observational study, to compare the effect of intraarticular steroid, hyaluronic acid, and platelet rich plasma in patients suffering from moderate OA of the knee.

THESIS SUMMARY

Introduction

Osteoarthritis is a disease of age related degeneration and inflammation in a load bearing joint. The prevalence of OA in India is reported to be in the range of 17 to 60.6%, more in urban area than in rural area. As per planning commission 2011, OA accounts for half of all chronic conditions in persons aged over 65 with about 25 % of people over the age of 60 have significant pain and disability from OA.

The hyaline cartilage of joint is made up of permanent cells, so there are less chance of repair and regeneration of cartilage. Mechanical factor as weight, varus / valgus malalignment and biochemical factor (inflammatory mediators) play pivotal role in the development of OA. Pain of OA can originate from any tissue of the joint and usually due to inflammation or mechanical irritation of joint.

There are many treatment options available for OA, which depends on

the stage of the disease. Early OA of knee is usually managed with non-pharmacological and non-surgical measures (physical therapy, weight reduction). In moderate OA (Kellgren Laurence grade 2 and 3) above measures usually fail and may require either stronger systemic analgesic, intraarticular injections or some surgical intervention. Since elderly people have more health challenges, it is not preferable to use long term stronger systemic analgesics, which may have dangerous side effect. In intraarticular injections, there are many options available e.g. steroid, hyaluronic acid, and platelet rich plasma (PRP). Platelet rich plasma is newer option in this field used for the repair and regeneration of cartilage. Local steroids are being used for pain relief in OA due to its strong anti-inflammatory and immunosuppressive property. Viscosupplementation with hyaluronic acid (HA) is another option. In body HA remains in the form of sodium hyaluronate instead of proton donor acid form. Exact guideline and indication of these three injections is yet to be established. We have done a comparative clinical study of intra articular steroid, sodium hyaluronate and platelet rich plasma in moderate OA of knee, to compare the result and efficacy of different injections.

Aims and Objectives

Our aim was to measure efficacy of intra-articular injections (THA, HA and PRP) in knee OA. The primary objective was to measure pain relief as measured by visual VAS and KSS at 0, 1, 4, 12, and 24 weeks after the IA injections. Our secondary objective was to measure functional status by KSS at 0, 1, 4, 12, and 24 weeks after the IA injections.

Material and Method

Study design: It was hospital based observational prospective cohort study.

Sample size: Two hundred and nine (209) knees of 124 patients of Kellgren Laurence grade 2 and 3 OA knee came to Indraprastha Apollo hospital New Delhi, and got intraarticular injection as treatment for knee OA.

Inclusion criteria

1. Any patient with a history of uni or bilateral knee pain for at least three months duration not responding to other non-interventional treatments.
2. Patients with X-ray findings of moderate OA (Kellgren Lawrence grade II/III).

Exclusion criteria

1. Systemic disorders such as diabetes and thyroid disorder
2. Inflammatory arthritis e.g. Rheumatoid arthritis
3. Major axial deviation at knee joint (varus $>5^\circ$, valgus $>5^\circ$)
4. Hematological diseases e.g. coagulopathy
5. Severe cardiovascular diseases
6. Any infective foci anywhere in the body
7. Immunosuppression
8. Malignancy

9. Age >80 years

10. Previous IA injection

Methodology

It was a clinical comparative study of intraarticular steroid (triamcinolone hexacetonate), hyaluronic acid (HA) and platelet rich plasma (PRP) in KL grade 2 and 3 OA. Forty patients (68 knees) were included in the steroid (first) group; patients of this group were given IA 40mg THA along with 10ml of 0.25% Bupivacaine. Forty-two patients (72 knees) were included in HA (second) group and were given IA 6ml (20mg) HA. Synvisc (Hylan polymer A and B, G-F 20) containing HMW elastoviscous fluid with long chain polymer chemically cross-linked was used. Forty-two patients (69 knees) were included in PRP (third) group and given IA PRP 6ml in each knee. All the injections were given after aspiration of excessive synovial fluid. The written informed consent of each patient was taken on the prescribed proforma. All the patients were examined and data was collected as per KSS and VAS score before injection and at subsequent follow-ups at 1, 4, 12, and 24 weeks. All the data were compared both within the group as well as with one another at different follow-up time.

To see response of these injections in different age group, each group was divided into two main subgroups, patients aged over 50 years and those aged 50 years or younger, and the result of each sub-group was analyzed. To see how these injections respond in different grade of each group was sub-divided into subgroup of KL grade 2 and KL grade 3 and result of both subgroups was compared. Wilcoxon sign rank test is used to compare data within a group, Wilcoxon, rank sum test, was used to compare data between two different groups.

Result

The mean age of all patients of three groups was 52 years with 32% of patient was male and 53% were of Kellgren Laurence grade 2 OA.

KSS pain: Baseline score of all the three groups had insignificant differences. All three groups had initial improvement in baseline pain score. Initial large improvement was seen in steroid (from 55.92 before injection to 77.30 at first week) and HA (60.14 to 75.56 at first week) group compared to PRP group (57.83 to 63.45 at first week). After 4 weeks of follow-up steroid group had rapid deterioration of score (at 24 weeks 61.75). In HA group deterioration started after 12 weeks but it was slow and maintained good result at the end of 24 weeks (76.80). In PRP group the KSS pain scores continuously improved gradually with time, and highest score (81.54) were noted at the end of study that is at 24 week.

KSS function: Baseline score difference of all the three groups was also insignificant in KSS function score. Similar to KSS pain score, a large improvement in first week KSS function score was seen in steroid and HA groups (50.62 to 73.25 and 52.92 to 83.41 respectively). Steroid group had rapid deterioration of score after 4 week while HA had gradual decrease after 12 weeks while PRP group had progressively increasing highest score at the end of study (score at 24 weeks 5.50, 70.60 and 77.26 respectively).

VAS score: Before the start of treatment there was significant difference in score between HA and PRP group. Trend of improvement of VAS score was similar to the KSS pain score but only difference seen was in PRP group VAS score started declining after 12 week follow-up.

Affect of patient's age on these treatment outcomes: Statistically better response from younger patients (age < 50 years) subgroup than older one, in all the three groups. After fourth weeks in steroid and twelfth weeks in HA, score of both subgroups score becomes comparable. While in PRP group significantly better result seen in younger age subgroup till 24 weeks. When elderly subgroup of HA compared with elderly subgroup of PRP, better result was seen in patient treated with HA.

Affect of grade of OA on treatment outcome: Better KSS pain score were seen in patients of subgroup KL grade 2 then those of KL grade 3, in all the three treatment groups. Steroid and HA had only short duration of significant difference while in PRP group it was till 24 weeks. KSS function has similar trend as of KSS pain. On VAS scale there was no difference between steroid and HA subgroups at any follow-ups, while significant difference seen in PRP group.

Conclusion

In the treatment of moderate OA, when physical therapy and other pharmacological therapy fails to relieve pain then intraarticular injection can be used, as short term measure. It is safe and effective. Though it is not a permanent solution for knee OA but it relieves pain, improve function and quality of life. In acute exacerbation of pain, intraarticular steroid can be given, it relieves pain rapidly and its effect lasts for 8-10 weeks. Effect of intraarticular hyaluronic acid lasts for few months, had good result in both grade 2 and grade 3. Hyaluronic acid was found to be better than PRP in grade 3 OA. Intraarticular PRP comparatively gives longer duration of pain relief and cost wise it is intermediate between HA and steroid. PRP is more effective in relatively younger age patients and lower degree of cartilage degeneration.

Clinical Message

In younger patients with mild to moderate knee OA, intra articular PRP is the better option whereas for older patients with moderate knee OA, either intra articular steroid or hyaluronic acid can be selected. Intra articular steroid gives shorter duration of pain relief

References

1. Kathleen DW. Recommendations for the medical management of osteoarthritis of the hip and knee. *Arthritis & Rheumatism* 2000; 43: 1905-15.
2. Jordan JM, Linder GF, Renner JB, Fryer JG. The impact of arthritis in rural populations. *Arthritis Care Res* 1995; 8(4):242-50.
3. Bland JH. The reversibility of osteoarthritis: a review. *Am J Med* 1983; 74(6A):16-26.
4. Manek NJ, Lane NE. Osteoarthritis: Current concepts in diagnosis and management. *Am Fam Physician* 2000; 61(6):1795-804.
5. Roemer FW, Eckstein F, Guermazi A. Magnetic resonance imaging-

based semi quantitative and quantitative assessment in osteoarthritis. *Rheum Dis Clin North Am* 2009; 35(3): 521-5.

6. Loeser RF. Age-related changes in the musculoskeletal system and the development of osteoarthritis. *Clin Geriatr Med* 2010; 26(3):371-86.
7. Engebretsen L, Storheim K, Risberg MA. Knee osteoarthritis after anterior cruciate ligament injury: a systematic review. *Am J Sports Med* 2009; 37(7):1434-43.
8. Tanamas S, Hanna FS, Cicuttini FM, Wluka AE, Berry P, Urquhart DM. Does knee malalignment increase the risk of development and progression of knee osteoarthritis? A systematic review. *Arthritis Rheum* 2009; 61(4):459-67.
9. Ayral X, Pickering EH, Woodworth TG, Mackillop N, Dougados M. Synovitis: a potential predictive factor of structural progression of medial tibio-femoral knee osteoarthritis: results of a 1 year longitudinal arthroscopic study in 422 patients. *Osteoarthritis Cartilage* 2005; 13(5): 361-7.
10. Golightly YM, Marshall SW, Kraus VB. Biomarkers of incident radiographic knee osteoarthritis: do they vary by chronic knee symptoms? *Arthritis Rheum* 2011; 63(8):2276-83.
11. Pelletier JP, DiBattista JA, Roughley P, McCollum R, Martel-Pelletier J. Cytokines and inflammation in cartilage degradation. *Rheum Dis Clin North Am* 1993; 19:545-68.
12. Kellgren JH, Lawrence JS. Radiological assessment of osteoarthrosis. *Annals of the Rheumatic Diseases* 1957; 16:494-501.
13. Roddy E, Zhang W, Doherty M. Evidence-based recommendations for the role of exercise in the management of osteoarthritis of the hip or knee-the MOVE consensus. *Rheumatology* 2005; 44, 67-73.
14. Pollo F, Otis J, Backus S, Warren R, Wickiewicz T. Reduction of medial compartment loads with valgus bracing of the osteoarthritic knee. *Am J Sports Med* 2002; 30, 414-21.
15. Erhart J, Mu¨ndermann A, Elspas B, Giori N, Andriacchi T. Changes in knee adduction moment, pain, and functionality with a variable-stiffness walking shoe after 6 months. *J Orthop Res* 2010; 28, 873-9.
16. French HP. Physiotherapy management of osteoarthritis of the hip: a survey of current practice in acute hospitals and private practice in the Republic of Ireland. *Physiotherapy* 2007; 93, 253-60.
17. Brosseau L, Yonge KA, Robinson V, Marchand S, Judd M, Wells G, Tugwell P. Thermotherapy for treatment of osteoarthritis. *Cochrane Database Syst Rev* 2003; (4):CD004522.
18. Kon E, Filardo G, Drobnic M, Madry H, Jelic M, van Dijk N, Della Villa S. Non-surgical management of early knee osteoarthritis. *Knee Surg Sports Traumatol Arthrosc* 2012; 20:436-449.
19. Yavuz U, Sökücü S, Albayrak A, Öztürk K. Efficacy comparisons of the intraarticular steroidal agents in the patients with knee osteoarthritis. *Rheumatol Int* 2012; 32: 3391-3396.
20. Ostergaard M, Halberg P. Intra-articular corticosteroids in arthritic disease: a guide to treatment. *Bio Drugs* 1998; 9:95-103.
21. Rozental TD, Sculco TP. Intra-articular corticosteroids: an updated overview. *Am J Orthop (Belle Mead NJ)* 2000; 29:18-23.
22. Reitingger S, Lepperdinger G. Hyaluronan, a ready choice to fuel regeneration: a mini review. *Gerontology* 2013; 59 71-76.
23. Fraser JR, Laurent TC, Laurent UB. Hyaluronan: its nature, distribution, functions and turnover. *J Intern Med.* 1997; 242(1) 27-33.

24. Juranek I, Stern R, Soltes L. Hyaluronan peroxidation is required for normal synovial function: a hypothesis. *Med Hypotheses*. 2014; 82(6):662-666.
25. Zhang FJ, Luo W, Gao SG, Su DZ, Li YS, Zeng C, Lei GH. Expression of CD44 in articular cartilage is associated with disease severity in knee osteoarthritis. *Mod Rheumatol* 2013; 23(6) 1186-1191.
26. Musumeci G, Loreto C, Carnazza ML, Cardile V, Leonardi R. Acute injury affects lubricin expression in knee menisci: an immunohistochemical study. *Ann Anat*. 2013; 195(2) 151-158.
27. Lurati A, Laria A, Mazzocchi D, Angela RK, Marrazza M, Scarpellini M. Effects of Hyaluronic Acid (HA) viscosupplementation on peripheral Th cells in knee and hip osteoarthritis. *Osteoarthritis Cartilage*. 2015; 23(1):88-93.
28. Zavan B, Ferroni L, Giorgi C, Calò G, Brun P, Cortivo R, Abatangelo G et al. Hyaluronic acid induces activation of the κ -opioid receptor. *PLoS One*. 2013; 8(1) e55510.
29. Bagga H, Burkhardt D, Sambrook P, March L. Long term effects of intraarticular hyaluronan on synovial fluid in osteoarthritis of the knee. *J Rheumatol*. 2006; 33(5):946-950.
30. Migliore A, Giovannangeli F, Granata M, Lagana B. Hylan G-F 20: review of its safety and efficacy in the management of joint pain in osteoarthritis. *Clin Med Insights Arthritis Musculoskelet Disord*. 2010; 3: 55-68.
31. Andia I, Abate M. Platelet rich plasma: underlying biology and clinical correlates. *Regen Med*. 2013; 8(5): 645-658.
32. Manfredini C, Maumus M, Gabusi E, Piacentini A, Filardo G, Peyrafitte JA, Jorgensen C et al. Adipose-derived mesenchymal stem cells exert anti-inflammatory effects on chondrocytes and synoviocytes from osteoarthritis patients through prostaglandin E2. *Arthritis Rheum*. 2013; 65(5): 1271-1281.
33. Xie X, Zhang C, Tuan RS. Biology of platelet-rich plasma and its clinical application in cartilage repair. *Arthritis Res Ther*. 2014 Feb 25; 16(1): 204.
34. Griffiths S, Baraniak PR, Copland IB, Nerem RM, McDevitt TC. Human platelet lysate stimulates high-passage and senescent human multipotent mesenchymal stromal cell growth and rejuvenation in vitro. *Cytherapy* 2013; 15(12):1469-1483.
35. Krüger JP, Endres M, Neumann K, Stuhlmüller B, Morawietz L, Häupl T, Kaps C. Chondrogenic differentiation of human subchondral progenitor cells is affected by synovial fluid from donors with osteoarthritis or rheumatoid arthritis. *J Orthop Surg Res*. 2012; 7: 10.
36. Spreafico A, Chellini F, Frediani B, Bernardini G, Niccolini S, Serchi T, Collodel G et al. Biochemical investigation of the effects of human platelet releasates on human articular chondrocytes. *J Cell Biochem*. 2009; 108(5): 1153-1165.
37. Christel P, Versier G, Landreau P, Djian P. Les greffes osteochondrales selon la technique de la mosaicplasty. *Maitrise Orthop*. 1998; 76:1-13.
38. Skwara A, Ponelis R, Tibesku CO, Rosenbaum D, Winkelmann SF. Gait patterns after intraarticular treatment of patients with osteoarthritis of the knee – hyaluronan versus triamcinolone: a prospective, randomized, double-blind, mono-centric study. *Eur J Med Res* 2009; 14: 157-164.
39. Petrella RJ, Petrella M. A prospective, randomized, double-blind, placebo controlled study to evaluate the efficacy of intraarticular hyaluronic acid for osteoarthritis of the knee. *J Rheumatol*. 2006; 33(5):951-6.
40. Caborn D, Rush J, Lanzer W, Parenti D, Murray C. A randomized, single-blind comparison of the efficacy and tolerability of hylan G-F 20 and triamcinolone hexacetonide in patients with osteoarthritis of the knee. *J Rheumatol*. 2004; 31(2):333-43.
41. Ozturk C, Atamaz F, Hepguler S, Argin M, Arkun R. The safety and efficacy of intraarticular hyaluronan with/without corticosteroid in knee osteoarthritis: 1-year, single-blind, randomized study. *Rheumatol Int*. 2006; 26(4):314-9.
42. Leopold SS, Redd BB, Warme WJ, Wehrle PA, Pettis PD, Shott S. Corticosteroid compared with hyaluronin acid injections for the treatment of osteoarthritis of the knee. A prospective, randomized trial. *J Bone Joint Surg Am*. 2003; 85-A (7):1197-203.
43. Forogh B, Mianehsaz E, Shoae S, Ahadi T, Raissi GR, Sajadi S. Effect of single injection of Platelet-Rich Plasma in comparison with corticosteroid on knee osteoarthritis: a double blind randomized clinical trial. *J Sports Med Phys Fitness*. In press 2015.
44. Filardo G, DiMatteo B, DiMartino A, Merli ML, Cenacchi A, Fornasari P, Marcacci M et al. Platelet-Rich Plasma Intra-articular Knee Injections Show No Superiority Versus Viscosupplementation: A Randomized Controlled Trial. *Am J Sports Med*. 2015; 43(7):1575-82.
45. Hur CI, Park C, Li H, Seon JK, Kim HK, Yoon TR, Song EK. Effect of Autologous Platelet-Rich Plasma on IL-6, MMP-3 and MCP-1 Expression in synoviocytes from osteoarthritic patients knees. *Open Journal of Regenerative Medicine* 2014, 3, 64-72.
46. Kalbkhani M, Dehghani SN, Najafpour A, Haddadi NS, Hossein KM. Effects of Platelet Rich Plasma in Treatment of Experimentally Induced Osteoarthritis in Rabbit's Knee Joint, *Advances in Stem Cells*, Vol. 2014 (2014), Article ID 994022.
47. Havva TC, Serap TS, Emel G, Canan H, Hatice S, Ali K, Metin K et al. Efficacy of intraarticular autologous platelet rich plasma application in knee osteoarthritis. *Arch Rheumatol* 2015; 30(x): i-viii.
48. Filardo G, Kon E, Ruiz MTP, Vaccaro F, Guitaldi R, Martino AD, Cenacchi A et al. Platelet-rich plasma intra-articular injections for cartilage degeneration and osteoarthritis: single- versus double-spinning approach. *Knee Surg Sports Traumatol Arthroscopy* 2012; 20(10):2082-91.
49. Sundman EA, Cole BJ, Karas V, Valle CD, Tetreault MW, Mohammed HO and Lisa. The Anti-inflammatory and Matrix Restorative Mechanisms of Platelet-Rich Plasma in Osteoarthritis. *The American Journal of Sports medicine* 2014; 42(1):35-41.
50. Raeissadat SA, Rayegani SM, Babaee M, Ghorbani E. The Effect of Platelet-Rich Plasma on Pain, Function, and Quality of Life of Patients with Knee Osteoarthritis. *Pain Res Treat*. 2013; 2013:165967.
51. Rayegani SM, Raeissadat SA, Taheri MS, Babaee M, Bahrami MS, Eliaspour D, Ghorbani E. Does intra articular platelet rich plasma injection improve function, pain and quality of life in patients with osteoarthritis of the knee? *Orthop Rev (Pavia)* 2014; 6(3):5405.
52. Laudy ABM, Bakker EWP, Rekers M, Moen MH. Efficacy of platelet-rich plasma injections in osteoarthritis of the knee: a systematic review and meta-analysis. *Br J Sports Med*. 2015 May; 49(10):657-72.
53. Raeissadat SA, Rayegani SM, Hassanabadi H, Fathi M, Ghorbani E,

- Babae M, Azma K. Knee Osteoarthritis Injection Choices: Hyaluronic acid versus platelet rich plasma. *Clinical Medicine Insights: Arthritis and Musculoskeletal Disorders* 2015; 8: 1–8.
54. Jang SJ, Kim JD, Cha SS. Platelet-rich plasma injections as an effective treatment for early osteoarthritis. *Eur J Orthop Surg Traumatol.* 2013 Jul; 23(5):573-80.
55. Kon E, Mandelbaum B, Buda R, Filardo G, Delcogliano M, Timoncini A, Fornasari PM et al. Platelet-rich plasma intra-articular injection versus hyaluronic acid viscosupplementation as treatments for cartilage pathology: from early degeneration to osteoarthritis. *Arthroscopy.* 2011 Nov; 27(11):1490-501.
56. Spakova T, Rosocha J, Lacko M, Harvanova D, Gharaibeh A. Treatment of knee joint osteoarthritis with autologous platelet-rich plasma in comparison with hyaluronic acid. *Am J Phys Med Rehabil.* 2012; 91(5):411-7.
57. Riboh JC, Saltzman BM, Yanke AB, Fortier L, Cole BJ. Effect of leukocyte concentration on the efficacy of platelet-rich plasma in the treatment of knee osteoarthritis. *Am J Sports Med.* 2016; 44(3):792-800.
58. Kanchanatawan W, Arirachakaran A, Chaijenkij K, Prasathaporn N, Boonard, Piyapittayanun P, Kongtharvonskul J. Short-term outcomes of platelet-rich plasma injection for treatment of osteoarthritis of the knee. *Knee Surg Sports Traumatol Arthrosc.* 2016; 24(5):1665-77.
59. Görmeli G, Görmeli CA, Ataoglu B, Çolak C, Aslantürk O, Ertem K. Multiple PRP injections are more effective than single injections and hyaluronic acid in knees with early osteoarthritis: a randomized, double-blind, placebo-controlled trial. *Knee Surg Sports Traumatol Arthrosc.* In press 2015.
60. Kon E, Buda R, Filardo G, Martino AD, Timoncini A, Cenacchi A, Fornasari PM et al. Platelet-rich plasma: intra-articular knee injections produced favourable results on degenerative cartilage lesions. *Knee Surg Sports Traumatol Arthrosc* 2010; 18(4):472-9.
61. Patel S, Dhillon MS, Aggarwal S, Marwaha N, Jain A. Treatment with platelet-rich plasma is more effective than placebo for knee osteoarthritis a prospective, double-blind, randomized trial. *The American Journal of Sports Medicine* 2013; 41(2):356-64.
62. Gobbi A, Karnatzikos G, Mahajan V, Malchira S. Platelet-Rich Plasma treatment in symptomatic patients with knee osteoarthritis: preliminary result in a group of active patients. *Sports Health.* 2012; 4(2): 162-72.
63. Cerza F, Carni S, Carcangiu A, Di Vavo I, Schiavilla V, Pecora A, De Biasi G et al. Comparison between hyaluronic acid and platelet-rich plasma, intra-articular infiltration in the treatment of gonarthrosis. *Am J Sports Med.* 2012; 40(12):2822-7.
64. Chang KV, Hung CY, Aliwarga F, Wang TG, Han DS, Chen WS. Comparative effectiveness of platelet-rich plasma injections for treating knee joint cartilage degenerative pathology: a systematic review and meta-analysis. *Arch Phys Med Rehabil.* 2014; 95(3): 562-75.
65. Sharma MK, Swami HM, Bhatia V, Verma A, Bhatia SP, Kaur G. 2007. An Epidemiological Study of Correlates of Osteo-Arthritis in Geriatric Population of UT Chandigarh. *Indian J Community Med*; 32:77-8
66. Radha MS, Gangadhar MR. Research article prevalence of knee osteoarthritis patients in mysore city, karnataka. *International Journal of Recent Scientific Research* 2015; 6(4):3316-3320.
67. Woolf AD, Pfleger B. Burden of major musculoskeletal conditions. *Bull World Health Organ* 2003; 81(9):646-56.
68. Frías G, Caracuel MA, Escudero A, Rumbao J, Pérez-Gujo V. Assessment of the efficacy of joint lavage versus joint lavage plus corticoids in patients with osteoarthritis of the knee. *Curr Med Res Opin* 2004; 20(6):861-7.
69. Filardo G, Kon E, Buda R, Timoncini A, Di Martino A. Platelet-rich plasma intra-articular knee injections for the treatment of degenerative cartilage lesions and osteoarthritis. *Knee Surg Sports Traumatol Arthrosc* 2011; 19(4): 528-35.
70. Kilincoglu V, Yeter A, Servet E, Kangal M, Yildirim M. Short term results comparison of intraarticular platelet rich plasma and hyaluronic acid applications in early stage of knee osteoarthritis. *Int J Clin Exp Med* 2015; 8(10):18807-18812.
71. Duymus TM, Mutlu S, Dernek B, Choice of intra-articular injection in treatment of knee osteoarthritis: platelet-rich plasma, hyaluronic acid or ozone options. *Knee Surgery Sports Traumatology Arthroscopy*. In press 2016.
72. Bellamy N, Campbell J, Robinson V, Gee T, Bourne R, Wells G. Intraarticular corticosteroid for treatment of osteoarthritis of the knee. *Cochrane Database Syst Rev* 2005; 18(2):CD005328.
73. Miyakoshi N, Kobayashi M, Nozaka K, Okada K, Shimada Y, Itoi E. Effects of intraarticular administration of basic fibroblast growth factor with hyaluronic acid on osteochondral defects of the knee in rabbits. *Arch Orthop Trauma Surg* 2005; 125:683-692.

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