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Ligamentopraxia of the Medial Complex in Knees with Medial Conflict

By Dr. Marco Antonio Schueda

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The Lyscholm scale score was used ranging between pre and postoperative from 31.56 to 94.31 points.

This technique is unprecedented and its effectiveness and replicability should be observed in new studies.

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I. Introduction

Osteoarthrosis (OA) is a localized and chronic joint disease that affects approximately one third of adults, with the prevalence of the disease increasing with advancing age[1]. The economic impact of knee OA is also a growing problem for healthcare systems. Demographic predictions indicate that people over 65 will make up more than 20% of the population by 2040[2], so knee OA will only become more prevalent.

The knee is the most common site on the lower limb for OA, with the disease affecting the tibiofemoral and patellofemoral joints alone or in combination. The medial tibiofemoral compartment is the most commonly affected (67% medial versus 16% lateral)[3]. Patients with knee OA often report symptoms of knee pain and difficulty with activities of daily living, such as walking, climbing stairs and household activities[4]. Ultimately, the pain and disability associated with the disease lead to a loss of functional independence and a profound reduction in quality of life.

Knee OA treatment strategies can be considered as primary prevention (reduction of risk factors to reduce the incidence of the disease); secondary prevention (interventions to delay/prevent progression to serious illness) or; tertiary prevention (treatment of pain and disability)[5].

Given that there is currently no cure for knee OA and the only established treatment for end-stage OA is joint replacement, slowing the progression of structural disease is essential to help reduce the personal and social burden of knee OA. Traditionally, disease progression has been assessed by measuring joint space loss over time from serial radiographs. There is an increasing use of MRI to measure cartilage volume in the knee as it has proven to be a valid and reproducible technique that is more sensitive to change than x-rays[6].

Increased load on the joint is important in the pathogenesis of knee OA. Interventions that alter knee load can reduce symptoms and delay disease progression in patients with knee OA. The knee adduction moment determines the load distribution on the medial and lateral tibial plateaus, with a force in the medial compartment almost 2.5 times greater than the lateral[7]. This may explain the much higher prevalence of medial OA compared to the lateral tibiofemoral joint.

The magnitude of this adduction moment is partially determined by the mechanical alignment of the knee. In medial knee OA, mechanical alignment becomes varus as the medial joint space narrows. Varus misalignment causes the ground reaction force vector to pass more medially to the center of the knee joint, resulting in a greater knee adduction moment. Cross-sectional studies demonstrate that patients with knee OA have a greater knee adduction moment during walking when compared to healthy controls of the same age[8,9].

Recent research has found that a longer adduction moment is associated with more intense pain in the knee[10] and greater severity of radiographic disease[11]. The severity of knee misalignment is also significantly associated with the intensity of knee pain and physical function[12]. Longitudinal studies have shown that a minimum increase of one unit at the time of adduction is associated with an increase of up to 6.5 times in the risk of disease progression[10,13]. Likewise, varus misalignment of the knee joint is also correlated with disease progression[12,14,15]. Given the importance of knee adduction timing and joint alignment in relation to symptom severity and disease progression in knee OA, conservative strategies to alter these biomechanical factors constitute a logical rehabilitation approach.

Alternatives to reduce the adductor moment using lateral wedges in the heels for alignment and demonstrated that insoles statically aligned the knee in a more upright position, shifting the calcaneus to a valgus position in relation to the tibia. Studies that such changes would help to reduce the excessive load on the medial articular surface, leading to knee pain mitigation.

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Since then, biomechanical studies have evaluated the effects of lateral wedge insoles on knee alignment and medial compartment load. However, despite its biomechanical effects, few randomized clinical trials have evaluated its clinical efficacy[16-20,24-26].

We classified varus knees as mild varus with mechanical femorotibial angle≤4° and moderate with mechanical femorotibial angle > 4°.

Treatments with osteotomies[27], much more for corrections of genu varus than in valgus[28] with similar results even with moderate varus29.

Our objective is, focusing on knees with mild varus (femorotibial angle < 4°), in addition to intra-articular corrections, perform ligamentopraxia (stretching by stretching by manipulation in valgus) of the medial complex, reducing the compression load on the medial compartment.

Evaluated preoperatively and postoperatively by X-Ray with monopodal support and Nuclear Magnetic Resonance, which qualified the femorotibial alignment and intra-articular lesions, as well as a specific and validated clinical questionnaire for the knee.

II. Material and Methods

16 knees of 13 patients with medial meniscal injuries and femoro-tibial alignment to mild genu varus (femoral-tibial diaphyseal mechanical angle < 4°), (Figure 1 A and 1 B).

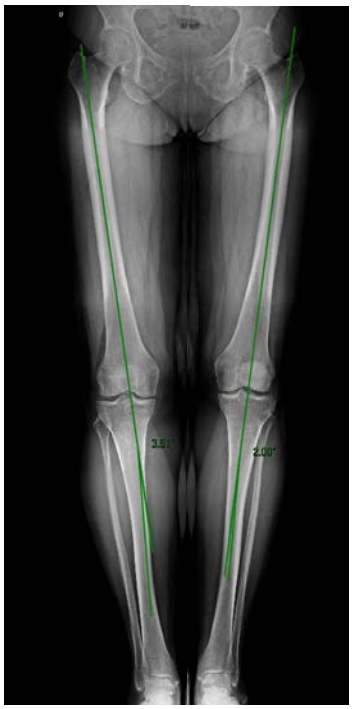

Fig. 1 A: Femorotibial angle of right knee 3.5° varus

Fig. 1 B: Femorotibial angle Left knee 2o varus

Surgically treated within one year (from 8/13/2020 to 8/13/2021) by the same orthopedist, undergoing in addition to video arthroscopy for resolution of intra-articular lesions, ligamentopraxia of the medial complex (medial collateral ligament and posterior oblique ligament) (Figure 2).

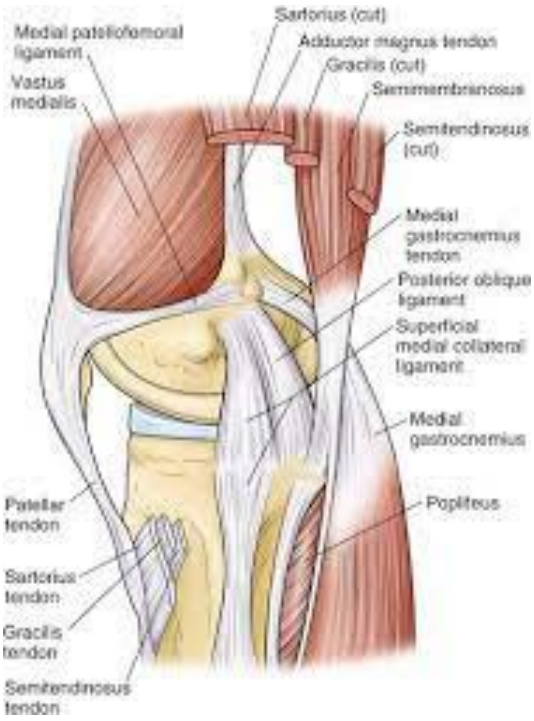

Fig. 2: Medial side of the knee with the medial collateral ligament and posterior oblique ligament. A redrawn from LaPrade, RF, Engebretsen AH, Ly TV, et al: The anatomy of the medial part of the knee. J Bone Joint Surg Am 89:2000, 2007.)

A valgus maneuver was performed at 20/30º stabilized by the auxiliary in the thigh after intra-articular saline solution was insufflated in the video arthroscopy (Figure 3A and 3B).

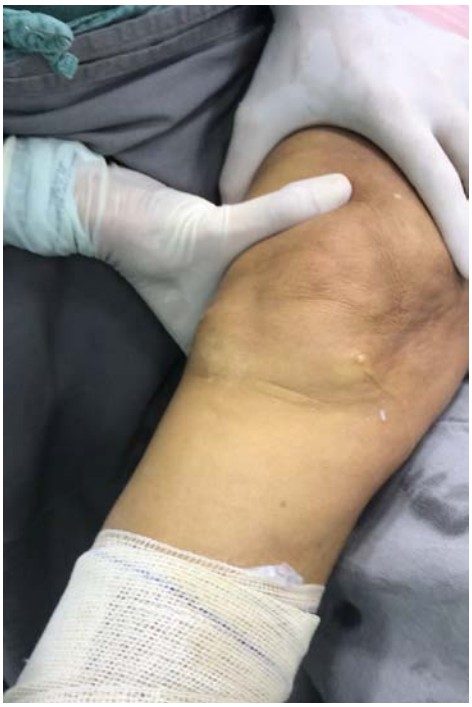

Fig. 3 A: Thigh stabilization

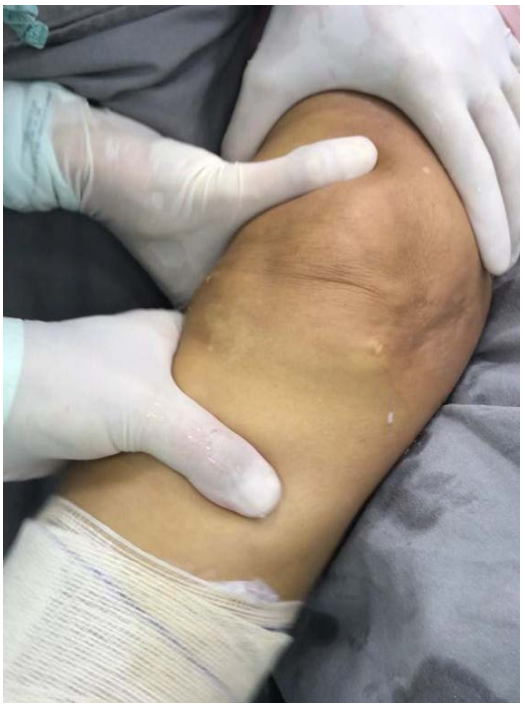

Fig. 3 B: Valgus maneuver at 20/30º of the knee lateralizing the leg with ligamentopraxia (stretching) of the medial complex

The radiographic femoro-tibial mechanical angles were calculated in AP with monopodal support and verified chondral and meniscal lesions in the pre- and postoperative radiographic study of Nuclear Magnetic Resonance 30-32 (Figure 4A and 4B).

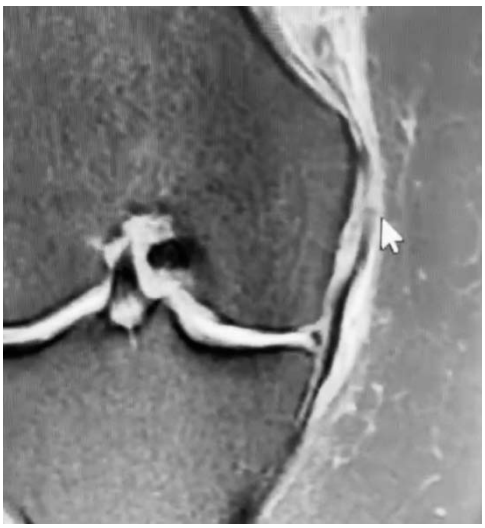

Fig. 4 A: Postoperative MRI photograph showing a shortened medial meniscus in the sagittal section (reflecting the meniscoplasty) and edema with stretching of the medial collateral ligament in its proximal third of its superficial and deep leaflets.

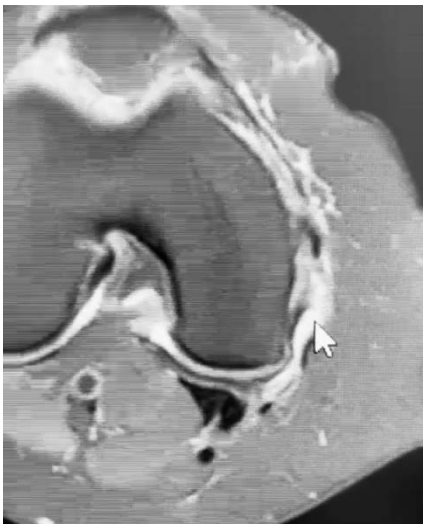

Fig. 4 B: Postoperative MRI photographs showing, in the axial section, in addition to the swelling with stretching of the superficial and deep medial collateral ligament, the oblique posterior ligament.

The Lyscholm[33] grading was used to assess the pre- and postoperative clinical evolution of the operated knees (Chart 1).

Table 1: Lyscholm scale score

Limping (5 points) Never = 5 Mild or periodically = 3 Strong and continuous = 0	**Pain (25 points)** No pain = 25 Intermittent or mild during strong-effort exercises = 20 Marked during strong-effort exercises = 15 Marked during or after walking more than 2 Km = 10 Marked during or after walking less than 2 Km = 5 Continuous = 0
Support (5 points) No support = 5 Walking stick or crutches = 2 Impossible = 0	**Swelling (10 points)** No swelling = 10 Upon strong-effort exercises = 6 Upon usual exercises = 2 Continuous = 0
Restraining (15 points) No restraining or restraining feeling = 15 Has the feeling, but no restraining = 10 Occasional restraining = 6 Frequent = 2 Joint restrained at examination = 0	**Climbing stairs (10 points)** No problem = 10 Slightly damaged = 6 One step at a time = 2 Impossible = 0
Instability (25 points) Never miss a step = 25 Seldom, during athletic activities or other strong-effort exercises = 20 Frequently during athletic activities or other strong-effort exercises (or unable to participate) = 15 Occasionally in daily activities = 10 Frequently in daily activities = 5 At each step = 0	**Squatting (5 points)** No problem = 5 Slightly damaged = 4 Not exceeding 90 degrees = 2 Impossible = 0 **Total score:**
Score table: Excellent: 95 – 100; Good: 84 – 94; Fair: 65 – 83; Poor: < 64	

III. Results

The procedures were performed in 12 patients (8 females and 4 males) in 16 knees (10 right knees and 6 left) bilateral ones were two females and two males (Table 1).

The femorotibial mechanical angle ranged from 3° of Valgus to 4° of Varus (weighted average of 0.41° of Varus).

The internal lesions involved grade III medial meniscus[30,31] and grade I to IV medial chondral lining[32].

pat	ag	gen	site	f/tâ	mri pré	lysholm pré	lysholm pós
mtbr	55	fem	rig	vr 2º	m iii ciii	25	93
mtbr	55	fem	lef	vr 2º	m iii cii	25	93
jwc	86	mal	rig	vl 3º	miii ciii	18	87
jwc	86	mal	lef	vl 2º	miii ciii	18	87
rcc	64	mal	lef	vr 4º	miii civ	42	99
moa	71	fem	tig	vr 0	miii civ	19	94
rvmc	65	fem	rig	vl2º	m iii ciii	17	99
oow	76	mal	rig	0º	m iii cii	57	95
oow	76	mal	lef	vr 1º	m iii cii	57	93
dp	58	mal	lef	vr 2º	m iii ciii	25	99
ats	57	fem	rig	vr 1º	m iii cii	34	92
nca	68	fem	rig	vl 2º	m iii cii	57	89
rcl	63	fem	rig	vl 1º	m iii ciii	40	95
cmg	66	fem	rig	vr3,5º	miii civ	47	98
msb	72	fem	rig	0º	miii cii	12	98
msb	72	fem	lef	vr 1º	miii civ	12	98

Table 2 – Patient Data: PAT = Patient; AG = Age; GEN = Gender; SIDE=Knee operated; F/TÂ= Femoro-tibial anatomical axis angle VL=Valgus VR = Varus; MRI PRE = Preoperative Nuclear Magnetic Resonance; M = Degree of Meniscal Injury, C = Degree of Chondral Injury; LYSHOLM PRE and LYSHOLM POST = Pre and Postoperative Lysholm Score.

IV. Discussion

The prevalence of knee OA has increased significantly in recent decades and continues to increase, and age, previous knee injuries, obesity (increased body mass index (BMI), joint misalignment and instability resulting in increased mechanical stress are all strong factors. risk for developing knee OA[34-38]

Physical inactivity is also another important contributor to the increased prevalence of OA, causing greater susceptibility to knee injuries due to less stable and weaker joints [39]. However, weakness of the knee extensor muscles appears to be a weak risk factor, compared to previous knee injuries[40].

Men are less likely to develop OA than women, making sex one of the risk factors associated with developing OA40. Narrower femurs, thinner patellas, larger quadriceps angles and differences in the size of the tibial condyles make women's knee anatomy different from men's, leading to different kinematics, which influence females to be more likely to develop OA, leading to a higher prevalence of OA in women[41,42].

In this study, we selected patients with meniscal injuries associated with knees with varus less than 4º, grade III meniscal injuries and varied chondral injuries.

In our sample, we had an average age of 68.13 years (55 to 86 years) being more prevalent in females, 66.67% of operated knees, which is in agreement with the literature[43].

The gradation of the tibial femur anatomical angle was 0.41º of varus (ranging from 3º of valgus to 4º of varus). Respecting the 4th of varus to be considered light varus. Literature agrees that from Moderate Varism (greater than 4º) the indications for osteotomies and arthroplasties would be of better therapeutic indication.

Meniscal injuries were all grade III, those without chondral or chondral injuries were type I 2%, type II 35.5%, type III 37.5% and type IV 25%.

All treated by the same surgeon, with meniscoplasty of the medial meniscus being performed by resection only of the injured area, respecting the maximum amount of intact tissue, chondroplasty by toilet or microfractures when necessary.

Preoperative Lysholm Scorres had a Weighted Average of 31.56 (13 to 57) and all qualified on the score as poor. In the evaluation by the same Score in the Postoperative period, the knees had a Weighted Average of 94.31 (87 to 99) 9 knees had a score as good and 6 as excellent.

Very positive results were obtained for the patients followed.

The purpose of this article serves as a presentation of this technique of ligamentopraxia of the medial collateral complex.

Specific videoarthroscopic meniscoplasty and chondroplasty are always performed for patients with femoro-tibial misalignment with varus to moderate.

V. Conclusion

In knees with moderate varus, the technique aims to improve the medial femoro-tibial conflict through the ligamentopraxia of the medial complex (medial collateral ligament and posterior oblique ligament).

Associated with the specific treatment of meniscal and chondral injuries, it improved the pre-to-postoperative score from 31.56 to 94.31 points.

As the technique is unprecedented, its efficacy and replicability must be observed with further studies.

Bibliographic References

1. Felson DT, Naimark A, Anderson J, Kazis L, Castelli W, Meenan RF. The prevalence of knee osteoarthritis in the elderly. The Framingham Osteoarthritis Study. Arthritis and Rheumatism. 1987; 30: 914–918. doi: 10.1002/art.1780300811. [PubMed] [CrossRef] [Google Scholar]
2. Hamerman D. Clinical implications of osteoarthritis and aging. Annals of the Rheumatic Diseases. 1995; 54: 82–85. [PMC free article] [PubMed] [Google Scholar]
3. Ledingham J, Regan M, Jones A, Doherty M. Radiographic patterns and associations of osteoarthritis of the knee in patients referred to hospital. Annals of Rheumatic Disease. 1993; 52: 520–526. [PMC free article] [PubMed] [Google Scholar]
4. Guccione AA, Felson DT, Anderson JJ, Anthony JM, Zhang Y, Wilson PWF, Kelly-Hayes M, Wolf PA, Kreger BE, Kannel WB. The effects of specific medical conditions on the functional limitations of elders in the Framingham study. American Journal of Public Health. 1994; 84: 351–358. [PMC free article] [PubMed] [Google Scholar]
5. Dieppe P, Brandt KD. What is important in treating osteoarthritis? Whom should we treat and how should we treat them? Rheum Dis Clin N Am. 2003; 29: 687–716. doi: 10.1016/S0889-857X(03)00054-1. [PubMed] [CrossRef] [Google Scholar]
6. Eckstein F, Schnier M, Haubner M, Priebsch J, Glaser C, Englmeier KH, Reiser M. Accuracy of cartilage volume and thickness measurements with magnetic resonance imaging. Clin Orthop. 1998; 352: 137–148. [PubMed] [Google Scholar]
7. Schipplein OD, Andriacchi TP. Interaction between active and passive knee stabilizers during level walking. Journal of Orthopaedic Research. 1991; 9: 113–119. doi: 10.1002/jor.1100090114. [PubMed] [CrossRef] [Google Scholar]
8. Bailunas AJ, Hurwitz DE, Ryals AB, Karrar A, Case JP, Block JA, Andriacchi TP. Increased knee joint loads during walking are present in subjects with knee osteoarthritis. Osteoarthritis & Cartilage. 2002; 10: 573–579. doi: 10.1053/joca.2002.0797. [PubMed] [CrossRef] [Google Scholar]
9. Hurwitz DE, Ryals AB, Case JP, Block JA, Andriacchi TP. The knee adduction moment during gait in subjects with knee osteoarthritis is more closely correlated with static alignment than radiographic disease severity, toe out angle and pain. J Orthop Res. 2002; 20: 101–108. doi: 10.1016/S0736-0266(01)00081-X. [PubMed] [CrossRef] [Google Scholar]
10. Miyazaki T, Wada M, Kawahara H, Sato M, Baba H, Shimada S. Dynamic load at baseline can predict radiographic disease progression in medial compartment knee osteoarthritis. Ann Rheum Dis. 2002; 61: 617–622. doi: 10.1136/ard.61.7.617. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
11. Sharma L, Hurwitz DE, Thonar E, Sum JA, Lenz ME, Dunlop DD, Schnitzer TJ, Kirwanmellis G, Andriacchi TP. Knee Adduction Moment, Serum Hyaluronan Level, and Disease Severity in Medial Tibiofemoral Osteoarthritis. Arthritis & Rheumatism. 1998; 41: 1233–1240. doi: 10.1002/1529-0131(199807)41:7<1233::AID-ART14>3.0.CO;2-L. [PubMed] [CrossRef] [Google Scholar]
12. Sharma L, Song J, Felson DT, Cahue SBS, Shamiyeh EMS, Dunlop DD. The role of knee alignment in disease progression and functional decline in knee osteoarthritis. JAMA. 2001; 286: 188–195. doi: 10.1001/jama.286.2.188. [PubMed] [CrossRef] [Google Scholar]
13. Sharma L, Dunlop D, Andriacchi T, Hayes K, Song J, Cahue S, Ryals A, Chang A, Hurwitz D. The adduction moment and knee osteoarthritis (OA): a longitudinal study. 67th ACR/ARHP Annual Scientific Meeting, Oct 23-28, Orlando, Florida. 2003.
14. Cerejo R, Dunlop DD, Cahue S, Channin D, Song J, Sharma L. The influence of alignment on risk of knee osteoarthritis progression according to baseline stage of disease. Arthritis & Rheumatism. 2002; 46: 2632–2636. doi: 10.1002/art.10530. [PubMed] [CrossRef] [Google Scholar]
15. Cicuttini F, Wluka AE, Hankin J, Wang Y. Longitudinal study of the relationship between knee angle and tibiofemoral cartilage volume in subjects with knee osteoarthritis. Rheumatology. 2004; 43: 321–324. doi: 10.1093/rheumatology/keh017. [PubMed] [CrossRef] [Google Scholar]
16. Sasaki T, Yasuda K. Clinical evaluation of the treatment of osteoarthritic knees using a newly designed wedged insole. Clinical Orthopaedics and Related Research. 1987; 221: 181–187. [PubMed] [Google Scholar]
17. Yasuda K, Sasaki T. The mechanics of treatment of the osteoarthritic knee with a wedged insole. Clinical Orthopaedics and Related Research. 1987; 215: 162–172. [PubMed] [Google Scholar]
18. Ogata K, Yasunaga M, Nomiyama H. The Effect of Wedged Insoles On the Thrust of Osteoarthritic Knees. International Orthopaedics. 1997; 21: 308–312. doi: 10.1007/s002640050174. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
19. Crenshaw SJ, Pollo FE, Calton EF. Effects of lateral-wedged insoles on kinetics at the knee. Clinical

Orthopaedics & Related Reseach. 2000; 375: 185–192. doi: 10.1097/00003086-200006000-00022. [PubMed] [CrossRef] [Google Scholar]
20. Kerrigan DC, Lelas JL, Goggins J, Merriman GJ, Kaplan RJ, Felson DT. Effectiveness of a lateral-wedge insole on knee varus torque in patients with knee osteoarthritis. Archives of Physical Medicine and Rehabilitation. 2002; 83: 889–893. doi: 10.1053/apmr.2002.33225. [PubMed] [CrossRef] [Google Scholar]
21. Butler RJ, Marchesi S, Royer T, Davis IS. The effect of a subject-specific amount of lateral wedge on knee mechanics in patients with medial knee osteoarthritis. J Orthop Res. 2007. [PubMed]
22. Giffin JR, Stanish WD, MacKinnon SN, MacLeod DA. Application of a lateral heel wedge as a nonsurgical treatment for varum gonarthrosis. Journal of Prosthetics and Orthotics. 1995;7:23–28. [Google Scholar]
23. Maillefert JF, Hudry C, Baron G, Kieffert P, Bourgeois P, Lechevalier D, Coutax A. Laterally elevated wedged insoles in the treatment of medial knee osteoarthritis: a prospective randomised controlled study. Osteoarthritis and Cartilage. 2001;9:738–745. doi: 10.1053/joca.2001.0470. [PubMed] [CrossRef] [Google Scholar]
24. Pham T, Maillefert JF, Hudry C, Kieffert P, Bourgeois P, Lechevalier D, Dougados M. Laterally elevated wedged insoles in the treatment of medial knee osteoarthritis. A twoyear prospective randomized controlled study. Osteoarthritis & Cartilage. 2003; 12: 46–55. doi: 10.1016/j.joca.2003.08.011. [PubMed] [CrossRef] [Google Scholar]
25. Baker K, Goggins J, Xie H, Szumowski K, LaValley M, Hunter DJ, Felson DT. A randomized crossover trial of a wedged insole for treatment of knee osteoarthritis. Arthritis Rheum. 2007; 56: 1198–1203. doi: 10.1002/art.22516. [PubMed] [CrossRef] [Google Scholar]
26. Bennell K, Bowles KA, Payne C, Ciccutini F, Osborne R, Harris A, Hinman REffects of laterally wedged insoles on symptoms and disease progression in medial knee osteoarthritis: a protocol for a randomised, double-blind, placebo-controlled trial BMC Musculoskelet Disord. 2007; 8: 96.
27. Peng H, Ou A, Huang X, Wang C, Wang L, Yu T, Zhang Y, Zhang Y Osteotomy Around the Knee: The Surgical Treatment of Osteoarthritis Orthop Surg. 2021 Jul; 13(5): 1465–1473. Journal ListOrthop Surgv.13(5); 2021 JulPMC8313165 Published online 2021 Jun 10. doi: 10.1111/os.13021 PMCID: PMC8313165 PMID: 34110088
28. Spahn G, Fritz J, Albrecht D, Angele P, Fickert S, Aurich M, Hofmann GO, Niemeyer P [Coincidence and Therapy of Dysalignments and Degenerative Knee Cartilage Lesions. Results from the German Cartilage Registry DGOU] [Article in German] Multicenter Study Z Orthop Unfall. 2017 Aug; 155(4): 457-467. doi: 10.1055/s-0043-108649. Epub 2017 May 18.
29. Gon Na Y, Lee BK, Hwang DH, Choi ES, Can osteoarthritic patients with mild varus deformity be indicated for high tibial osteotomy? Full length article| volume 25, issue 5, p856-865, october 01, 2018
30. Jae Ang Sim. Published: June 20,2018 DOI:https://doi.org/10.1016/j.knee.2018.05.001
31. Crues JV, Mink J, Levy TL, Lotysch M, Stoller DW. Meniscal tears of the knee: accuracy of MR imaging. Radiology 1987; 164: 445-8.
32. Stoller DW, Martin C, Crues JV, Kaplan L, Mink JH. Meniscal tears: pathological correlation with MR imaging. Radiology 1987; 163: 731-5.
33. Rodrigues MB, CamanhoGL Avaliação da cartilagem do joelho pela ressonância magnética. Rev. bras. ortop. 45 (4) – 2010.
34. PeccinMS, Ciconelli R, Cohen M, Questionário específico para sintomas do Joelho "Lysholm Knee Scoring Scale" – tradução e validação para a língua portuguesa. Acta ortop bras 14(5) 268-273- 2006.
35. Sung-Do Cho, Yoon-Seok Youm, Jong-Hyun Kim, Hye-Yong Cho, Kwang-Ho Kim, Patterns and Influencing Factors of Medial Meniscus Tears in Varus Knee Osteoarthritis Knee Surg Relat Res 2016 Jun; 28(2): 142-146 https://doi.org/10.5792/ksrr.2016.28.2.142
36. Nguyen U.-S.D.T., Zhang Y., Zhu Y., Niu J., Zhang B., Felson D.T. Increasing Prevalence of Knee Pain and Symptomatic Knee Osteoarthritis: Survey and Cohort Data. Ann. Intern. Med. 2011; 155: 725–732. doi: 10.7326/0003-4819-155-11-201112060-00004. [PMC free article][PubMed] [CrossRef] [Google Scholar]
37. Shane Anderson A., Loeser R.F. Why is osteoarthritis an age-related disease? Best Pract. Res. Clin. Rheumatol. 2010; 24: 15–26. doi: 10.1016/j.berh.2009.08.006. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
38. Felson D.T. Osteoarthritis as a disease of mechanics. Osteoarthr. Cartil. 2013; 21: 10–15. doi: 10.1016/j.joca.2012.09.012. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
39. Vina E.R., Kwoh C.K. Epidemiology of osteoarthritis. Curr. Opin. Rheumatol. 2018; 30: 160–167. doi: 10.1097/BOR.0000000000000479.[PMC free article] [PubMed] [CrossRef] [Google Scholar]
40. Berenbaum F., Wallace I.J., Lieberman D.E., Felson D.T. Modern-day environmental factors in the pathogenesis of osteoarthritis. Nat. Rev. Rheumatol. 2018; 14: 674–681. doi: 10.1038/s41584-018-0073-x. [PubMed] [CrossRef] [Google Scholar]
41. Hunter D.J., Bierma-Zeinstra S. Osteoarthritis. Lancet. 2019; 393: 1745–1759. doi: 10.1016/S0140-

6736(19)30417-9. [PubMed] [CrossRef] [Google Scholar]
42. Hame S.L., Alexander R.A. Knee osteoarthritis in women. Curr. Rev. Musculoskelet. Med. 2013; 6: 182–187. doi: 10.1007/s12178-013-9164-0.[PMC free article] [PubMed] [CrossRef] [Google Scholar]
43. Long H., Zeng X., Liu Q., Wang H., Vos T., Hou Y., Lin C., Qiu Y., Wang K., Xing D., et al. Burden of osteoarthritis in China, 1990–2017: Findings from the Global Burden of Disease Study 2017. Lancet Rheumatol. 2020; 2: e164–e172. doi: 10.1016/S2665-9913(19)30145-6. [CrossRef] [Google Scholar]
44. Zhang Y., Jordan J.M. Epidemiology of Osteoarthritis. Clin. Geriatr. Med. 2010; 26: 355–369. doi: 10.1016/j.cger.2010.03.001. [PMC free article] [PubMed] [CrossRef] [Google Scholar]