Research Article

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Adductor Moment, Genu Varus and the Ligamentopraxy of the Medial Complex in Knees with Medial Conflict

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Abstract

In knees of patients over 50 years old, with mild varus (femoro-tibial angle up to 4° of varus), the medial complex ligamentopraxy technique (medial collateral ligament and posterior oblique ligament) was used in association with the specific treatment of medial meniscal and chondral injuries. The objective was to improve the femoro-tibial conflict, favoring functional rehabilitation in knees with misalignment in their anatomical axis. 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.

Keywords: Genu varus, medial meniscal injury, medial ligamentopraxia.

Introduction

Women and individuals over 50 years of age in regions with a higher sociodemographic index are identified as populations and areas at high risk for osteoarthritis (OA). The number of disability-adjusted life years lost will continue to increase over the next 25 years (Ren et al., 2025).

The economic impact of knee OA is also a growing problem for health systems. Demographic forecasts indicate that people over the age of 65 will make up more than 20% of the population in 2040, so knee OA will become increasingly prevalent (ZHANG et al., 2025).

The knee is the most common lower extremity site for OA, with the disease affecting the tibiofemoral and patellofemoral joints alone or in combination (Ledingham et al., 1993). The estimated prevalence rates (95% CI) are: unicompartimental 50%, with medial tibiofemoral 27%, patellofemoral 18% and lateral osteoarthrosis 15%. Bicompartmental 33% and tricompartmental only 17% (Stoddart et al., 2021).

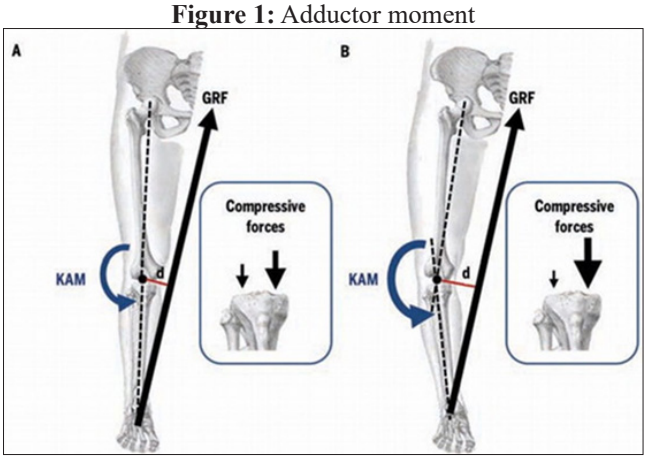
Three-quarters of people with knee OA do not have tricompartmental disease. This is not reflected in the frequency with which partial and combined knee arthroplasties are currently used (Stoddart et al., 2021).

The biomechanical etiology draws attention to the **Knee Adductor Moment (KAM)**, which is the rotational force (torque) that acts on the frontal plane during gait. It represents the tendency of the tibia to move medially in relation to the femur, concentrating the load in the medial compartment of the knee (Levinger et al., 2013; Farrokhi et al., 2013). (FIG. 1).

The longer the adductor moment, the greater the compressive load on the medial part of the knee, precisely where wear occurs in medial arthrosis (Levinger et al., 2013). During gait, the KAM typically has two peaks: First peak Just after heel contact (initial stance phase). Second peak during the impulse (final support phase). The first peak is most strongly correlated with the progression of medial arthrosis (Levinger et al., 2013).

Increased hindfoot eversion, hindfoot internal rotation, and forefoot inversion is associated with reduced knee adduction moments during the stance phase of gait, suggesting that the load on the medial knee joint is reduced in people with osteoarthritis who walk with greater foot pronation. These findings have implications for the development of load modification interventions in people with knee osteoarthritis (Levinger et al., 2013).

Figure 1: Adductor moment



(Farrokhi et al., 2013)

We qualified varus knees as light mechanical femorotibial angle ≤5°, moderate > 5° and severe and severe when > 10º.C (Table 1).

Table 1: Degrees, angles and characteristics of Varo

Degree	Mechanical Angle	Clinical Characteristics
Mild	< 5°	Initial medial load alteration, mild pain, no fixed deformity
Moderate	5 – 10°	Visible deviation, pain on weight-bearing, beginning of medial meniscal collapse
Severe	> 10°	Rigid deformity, complete narrowing of the medial joint line, tibial subluxation

(Colyn et al., 2022)

In patients with moderate knee OA, changes in the muscle activation pattern (MAP) are mainly related to symptoms and difficulty in tasks. Changes in MAP mainly result in variations in amplitude, duration of contraction, muscle synergy, and coactivation index (ICC). Changes in MAP can subsequently affect intermuscular structure, pain, joint loading, and stiffness. Clinical rehabilitation treatments can focus on changes in MAP to break this cycle and help mitigate disease progression (Liu et al., 2025).

There are numerous forms of drug treatment, but it would not be pertinent to discuss it in this article (Cai et al., 2021).

JAD (Distraction Knee Joint) causes a clear benefit in clinical and structural parameters, both in the short and long term. Significant improvements were found in all primary endpoints and the benefit lasted up to at least 9 years (Jansen et al., 2020; Hoorntje et al., 2020; Struik et al., 2023).

Treatments with osteotomies (Peng et al., 2021), much more for genu varus corrections than in valgus (Spahn et al., 2017) with similar results even with moderate varus (Na et al., 2018).

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

A trend has developed toward less invasive surgeries, with unicompartmental knee arthroplasty (JUA) and high tibial osteotomy (OTA) gaining increasing popularity. Surgeons differ as to the relative indications and contraindications for performing these procedures. Total knee arthroplasty (TKA) continues to have the lowest overall revision rate among the available options. Growing evidence demonstrates more favorable outcomes reported by patients undergoing JAU and OTA, compared with TKA.

Distraction knee joint (JAD) has been shown to be an alternative method of treatment in these patients (McCormack et al., 2021).

Materials and Methods

Evaluated in the preoperative and postoperative periods, by X-ray with monopedal support and Magnetic Resonance Imaging, which qualified the femorotibial alignment and intra-articular lesions, as well as by a specific and validated clinical questionnaire for the knee.

A total of 16 knees from 13 patients with medial meniscal injuries and femorotibial alignment to mild genu varus (femorotibial diaphyseal mechanical angle < 4º) were analyzed (Figures 2 A and 2 B).

Figure 2: A - Femorotibial angle knee Right 3.5o varus. B - Femorotibial angle of the knee Left 2nd varus.

The patient was surgically treated by the same orthopedist, and was submitted to video arthroscopy to resolve the intra-articular lesions to the ligamentopraxy of the medial complex (medial collateral ligament and posterior oblique ligament) (Figure 3).

Figure 3: Illustration of the main structures of the medial region (right knee).

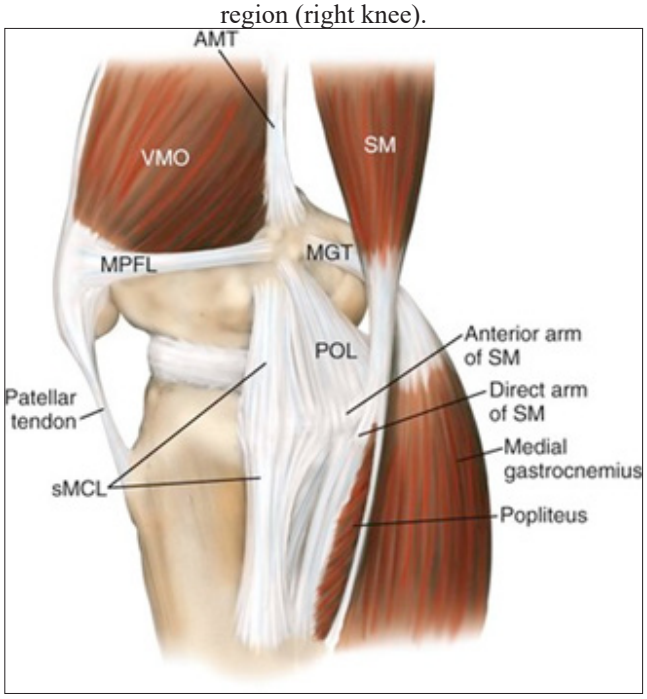


Illustration of the main medial knee structures (right knee). VMO = vas- tus medialis obliquus muscle, MPFL = medial patellofemoral ligament, POL = posterior oblique ligament, MCL = superficial medial collateral ligament, SM = semimembranosus muscle, MGT = medial gastrocnemius tendon, and AMT = adductor magnus tendon. Laprade RF, Engebretsen AH, Ly TV et al.: The anatomy of the medial side of the knee. J Bone Surg Am 89.2000/2007).

A valgus maneuver is performed at 20/30º stabilized by the assistant in the thigh after intra-articular saline solution has been inflated in the video arthroscopy (Figures 4 A and 4 B).

Figure 4: A – Stabilization of the thigh.
B – Valgus maneuver at 20/30° of the knee lateralizing the leg with ligamentopraxy (stretching) of the medial complex.

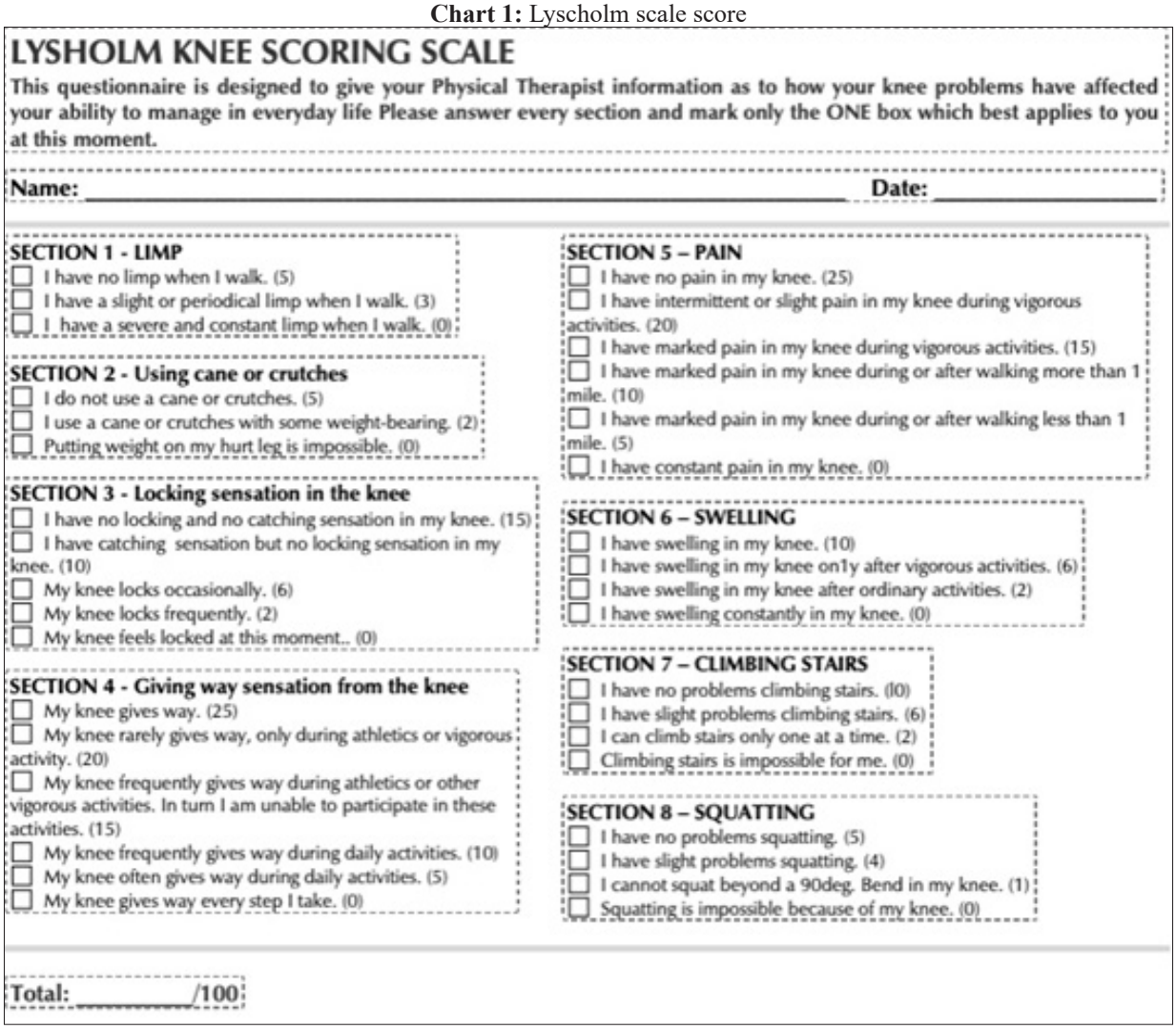
The femorotibial radiographic mechanical angles were calculated in PA with monopodal support and chondral and meniscal lesions were verified in the radiographic study of the preoperative and postoperative Nuclear Magnetic Resonance (Figures 5A and 5B) (Crues et al., 1987; Stoller et al., 1987; Rodrigues & Camanho, 2010).

Figure 5 A: Photograph of the postoperative MRI showing the shortened medial meniscus sagittal section (reflecting meniscoplasty) and edema with stretching of the medial collateral ligament in its proximal third of its superficial and deep leaflets.

Figure 5 B: Postoperative MRI photographs showing the posterior oblique ligament in addition to the edema with stretching of the superficial and deep medial collateral ligament

The Lyscholm grade (Peccin et al., 2006) was used to evaluate the pre- and postoperative clinical evolution of the operated knees (Chart 1).

Chart 1: Lyscholm scale score



LYSHOLM KNEE SCORING SCALE

This questionnaire is designed to give your Physical Therapist information as to how your knee problems have affected your ability to manage in everyday life Please answer every section and mark only the ONE box which best applies to you at this moment.

Name: _____ **Date:** _____

SECTION 1 - LIMP
- ☐ I have no limp when I walk. (5)
- ☐ I have a slight or periodical limp when I walk. (3)
- ☐ I have a severe and constant limp when I walk. (0)

SECTION 2 - Using cane or crutches
- ☐ I do not use a cane or crutches. (5)
- ☐ I use a cane or crutches with some weight-bearing. (2)
- ☐ Putting weight on my hurt leg is impossible. (0)

SECTION 3 - Locking sensation in the knee
- ☐ I have no locking and no catching sensation in my knee. (15)
- ☐ I have catching sensation but no locking sensation in my knee. (10)
- ☐ My knee locks occasionally. (6)
- ☐ My knee locks frequently. (2)
- ☐ My knee feels locked at this moment.. (0)

SECTION 4 - Giving way sensation from the knee
- ☐ My knee gives way. (25)
- ☐ My knee rarely gives way, only during athletics or vigorous activity. (20)
- ☐ My knee frequently gives way during athletics or other vigorous activities. In turn I am unable to participate in these activities. (15)
- ☐ My knee frequently gives way during daily activities. (10)
- ☐ My knee often gives way during daily activities. (5)
- ☐ My knee gives way every step I take. (0)

SECTION 5 – PAIN
- ☐ I have no pain in my knee. (25)
- ☐ I have intermittent or slight pain in my knee during vigorous activities. (20)
- ☐ I have marked pain in my knee during vigorous activities. (15)
- ☐ I have marked pain in my knee during or after walking more than 1 mile. (10)
- ☐ I have marked pain in my knee during or after walking less than 1 mile. (5)
- ☐ I have constant pain in my knee. (0)

SECTION 6 – SWELLING
- ☐ I have swelling in my knee. (10)
- ☐ I have swelling in my knee on1y after vigorous activities. (6)
- ☐ I have swelling in my knee after ordinary activities. (2)
- ☐ I have swelling constantly in my knee. (0)

SECTION 7 – CLIMBING STAIRS
- ☐ I have no problems climbing stairs. (l0)
- ☐ I have slight problems climbing stairs. (6)
- ☐ I can climb stairs only one at a time. (2)
- ☐ Climbing stairs is impossible for me. (0)

SECTION 8 – SQUATTING
- ☐ I have no problems squatting. (5)
- ☐ I have slight problems squatting. (4)
- ☐ I cannot squat beyond a 90deg. Bend in my knee. (1)
- ☐ Squatting is impossible because of my knee. (0)

Total: _____/100

(Peccin et al., 2006)

Results

The procedures were performed in 12 patients (8 females and 4 males) in 16 knees (10 right and 6 left knees), two bilateral knees were female and two male (Chart 2).

The femorotibial mechanical angle ranged from 3º valgus to 4º varus (weighted mean of 0.41º varus).

The internal lesions were involving grade III medial meniscus and grade I to IV medial chondral lining (Crues et al., 1987; Stoller et al., 1987; Rodrigues & Camanho, 2010). Video arthroscopes were removed without total removal of intra-articular saline, ligamentopraxia was performed, and definitive treatments with meniscoplasty and/or chondroplasty were performed in second view.

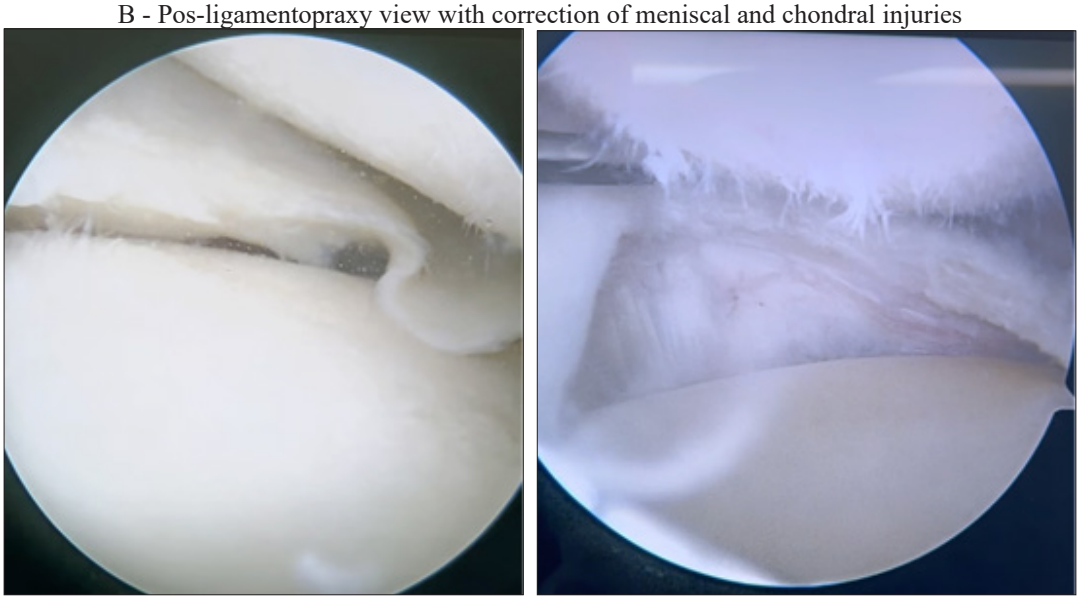
The post-ligamentopraxy view is much broader. (Figures 6 A and 6 B)

Chart 2: Patient Data

No	ID	SEXO	LADO	ÂF/T	RNM PRÉ	LYSHOLM PRÉ	LYSHOLM PÓS
MTBR	55	FEM	DIR	VR 2º	M III CIII	25	93
MTBR	55	FEM	ESQ	VR 2º	M III CII	25	93
JWC	86	MASC	DIR	VL 3º	MIII CIII	18	87
JWC	86	MASC	ESQ	VL 2º	MIII CIII	18	87
RCC	64	MASC	ESQ	VR 4º	MIII CIV	42	99
MOA	71	FEM	DIR	VR 0	MIII CIV	19	94
RVMC	65	FEM	DIR	VL2º	M III CIII	17	99
OOW	76	MASC	DIR	0º	M III CII	57	95
OOW	76	MASC	ESQ	VR 1º	M III CII	57	93
DP	58	MASC	ESQ	VR 2º	M III CIII	25	99
ATS	57	FEM	DIR	VR 1º	M III CII	34	92
NCA	68	FEM	DIR	VL 2º	M III CII	57	89
RCIL	63	FEM	DIR	VL 1º	M III CIII	40	95
CMG	66	FEM	DIR	VR 3,5º	MIII CIV	47	98
MSB	72	FEM	DIR	0º	MIII CII	12	98
MSB	72	FEM	ESQ	VR 1º	MIII CIV	12	98

No = Identification; ID = Age; Sexo = Gender; Lado = Knee operated; ÂF/T= Anatomical Eixo Angle Fêmoro-tibial VL=Valgo VR = Varo; RNM PRÉ= Preoperative Nuclear Magnetic Resonance Imaging; M= Degree meniscos tears, C= Degree of Chondral Injury; LYSHOLM PRÉ e LYSHOLM PÓS = Lysholm Score pre-op and pós op
M=Menisco; C= Condral

Figure 6 A - Arthroscopic view of medial meniscal and chondral injury pre-ligamentopraxia
B - Pos-ligamentopraxy view with correction of meniscal and chondral injuries



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 risk factors for the development of knee OA (Ren et al., 2025; Vina & Kwoh, 2018).

Physical inactivity is also another important contributor to the increased prevalence of OA, causing increased susceptibility to knee injuries due to less stable and weaker joints (Ren et al., 2025). However, weakness of the knee extensor muscles appears to be a weak risk factor, compared with previous knee injuries.

Men are less likely to develop OA than women, making gender one of the risk factors associated with developing OA (Ren et al., 2025). Narrower femurs, thinner patellas, larger quadriceps angles, and differences in tibial condyle size make women's knee anatomy different from men's, leading to different kinematics, which influences females to be more likely to develop OA, leading to a higher prevalence of OA in women (Ren et al., 2025; Long et al., 2020).

In this study, we selected patients with meniscal injuries associated with knees with varus less than 4º, meniscal injuries In our sample, we had a mean age of 68.13 years (55 to 86 years), with 66.67% of the operated knees being more prevalent in females, which is in agreement with the literature (Levinger et al., 2013; Zhang & Jordan, 2010).

The graduation of the tibial femorus anatomical angle was 0.41º varus (ranging from 3º valgus to 4º varus). Respecting the 4th of varus to be considered light varus. The literature agrees that from moderate varism (greater than 4º) the indications for osteotomies and arthroplasties would be of better therapeutic indication (Levinger et al., 2013).

The meniscal lesions were all grade III, those without chondral lesions or chondral lesions of type I 2%, type II 35.5%, type III 37.5% and type IV 25%.

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

The Lysholm Scores in the Pre operative period obtained a Weighted Mean of 31.56 (13 to 57), and all of them were classified in the score as poor. In the evaluation by the same Postoperative Score of the knees Weighted Mean of 94.31 (87 to 99) 8 knees obtained a score of good and 8 of excellent.

Very positive results were obtained for the patients followed. The objective of this article is to present this technique of ligamentopraxia of the medial collateral complex.

Specific meniscoplasty and video arthroscopic chondroplasty are always performed for patients with femorotibial misalignment with varus to moderate.

Conclusion

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

Associated with the specific treatment of meniscal and chondral lesions, the preoperative to postoperative score improved from 31.56 to 94.31 points. Since the technique is new, its efficacy and replicability should be observed with new studies.

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