

Occurrence of patellofemoral osteoarthritis at medium and long-terms after isolated medial patellofemoral ligament reconstruction with medial third of patellar tendon

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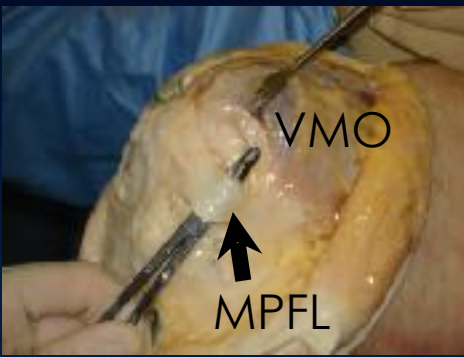


DISCLOSURES

Presenter: Zimmer US, inc.
Arthrex, inc.



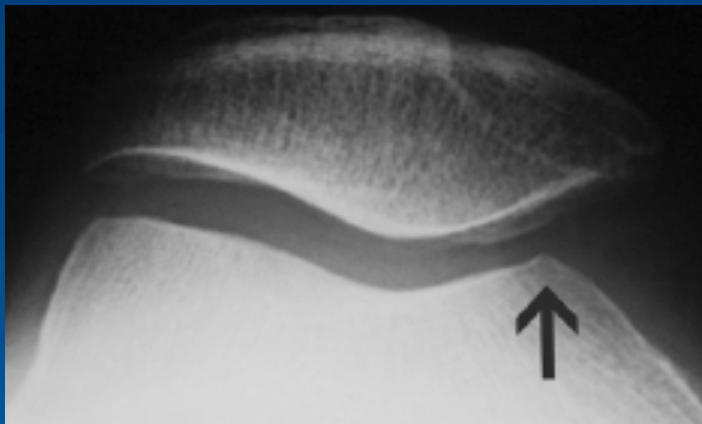
INTRODUCTION



MPFL reconstruction
few long-term researchs



NO osteoarthritis!



distal/proximal realignment,
“menu à la carte” and trochleoplasty
many long-term researchs

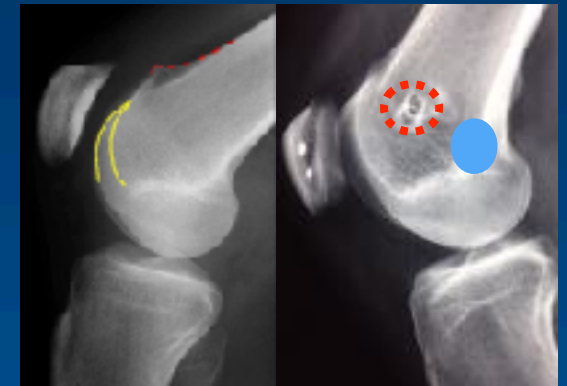


development of
OSTEOARTHRITIS!



MPFL surgical technical errors:

↑ recurrences
↓ functional results
overload PF cartilage
arthritic changes



MPFL reconstruction with medial third of patellar tendon in the treatment of recurrent patellar instability (RPI)

PURPOSE

Primary: to evaluate the occurrence of patellofemoral osteoarthritis (OA) at medium and long-terms.

Secondary: to correlate with

- femoral tunnel positioning
- trochlear dysplasia
- patellar height
- pre-existing chondral lesions
- follow-up period
- gender
- age



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METHODS

- Local ethics committee approved number: CAEE 63244016.5.0000.00065.
- Study design: case series with 69 patients (86 knees).
- Isolated MPFL reconstruction with medial third of patellar tendon performed by a single surgeon between 2004-2016 for recurrent patellar instability (RPI: 2 or + dislocations).
- INSTITUTION: Orthopedics and Traumatology Department of Hospital Universitário Cajuru - PUCPR, Curitiba-PR, Brazil.
- Evaluation: Kujala score and standard X-ray (independent examiner).
- Minimum follow-up: 24 months.



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METHODS

- Inclusion criteria: 15-45 yrs, RPI despite of patella alta and trochlear dysplasia.
 - Exclusion criteria: TT-TG > 20mm, simultaneous patellar realignment, previous surgeries, simultaneous repaired chondral lesions, syndromic diseases, concomitant ligament or meniscal tears, arthritic changes on knee.
 - Functional evaluation: recurrence rate, Kujala score.
 - Pre-existing chondral lesion: Outerbridge classification.
 - Radiographic features: patellar height (Caton-Deschamps index), trochlear dysplasia (Dejour classification A-D), femoral tunnel positioning (modified Schöttle's method), patellofemoral OA (Iwano classification).
 - Statistical analysis: uni and multivariate correlation between variables and Kujala score and patellofemoral OA.
- Significance $P < 0.05$.

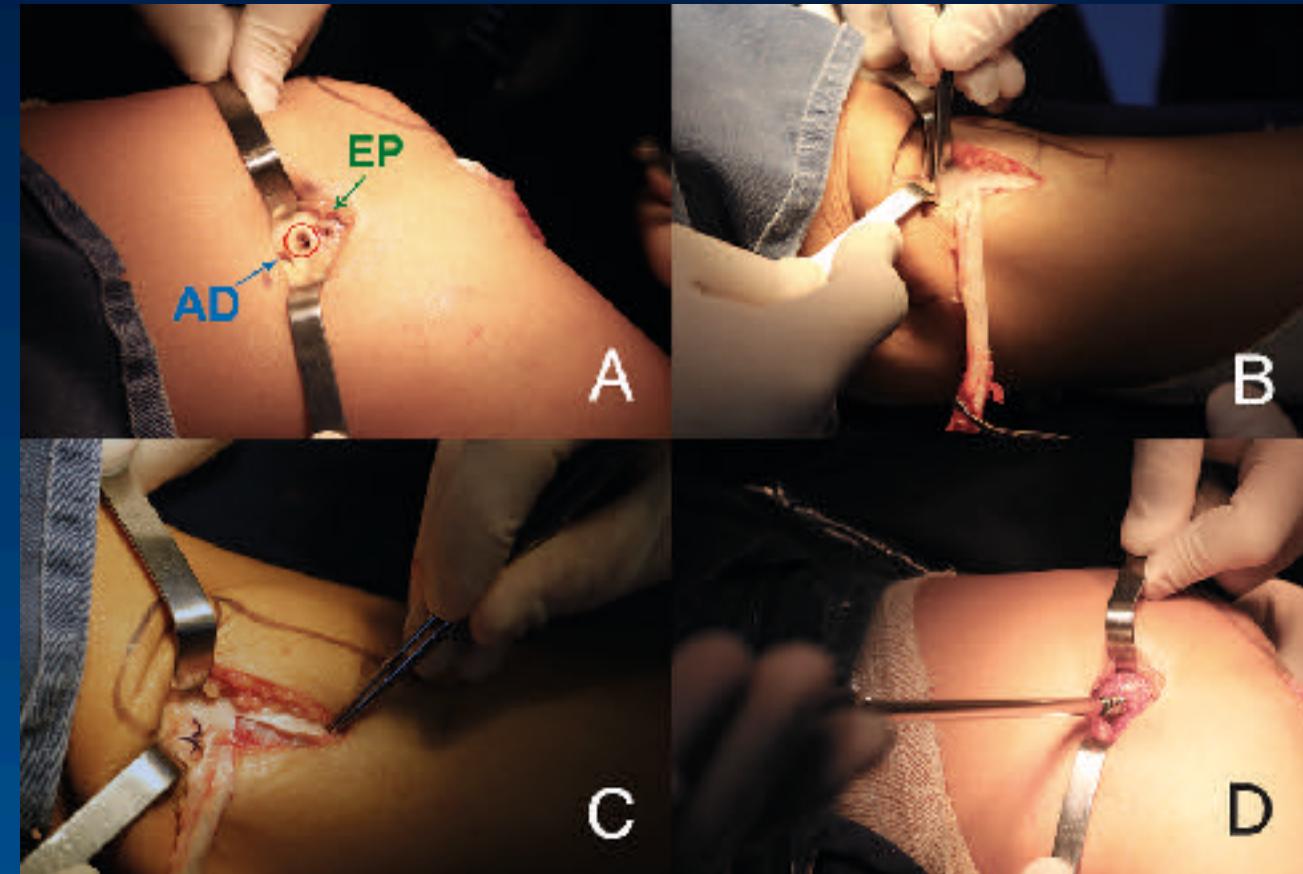


MPFL reconstruction with medial third of patellar tendon in the treatment of RPI

Surgical technique: Camanho et al. (2007)*



- A) Femoral tunnel located between medial epicondyle (EP) and adductor tubercle (AD) (Nomura's point).
- B) Subperiosteal dissection of the medial third of patellar tendon with bone plug up to the transition of proximal and middle thirds of medial patellar ridge (Steensen et al, 2004).
- C) Patellar graft fixation with sutures at the periosteum.
- D) Femoral graft fixation with interference screw between 45-60° of knee flexion.



* Camanho GL, Bitar AC, Hernandez AJ, Olivi R. Medial patellofemoral ligament reconstruction: a novel technique using the patellar ligament. Arthroscopy. 2007;23(1):108.e1-4.



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Results: general data

variable	n	classification or type	result*
age (years)	69		26,1 ± 8 (15 - 45)
gender	47	female	68,1%
	22	male	21,9%
side	43	right	50%
	43	left	50%
follow-up (months)	86	general	72,2 ± 37,5 (24 - 163)
mid-term	33	24-59 mths	33,9 ± 10
long-term	53	> 60 mths	93,4 ± 25

variable	n	classification	result*
femoral tunnel	14	poor	16,3%
	20	good	23,3%
	52	excellent	60,4%
femoral tunnel	72	good/ excellent	83,7%
	14	poor	16,3%
patellar height	86		1,2 ± 0,2 (0,9 - 1,8)
	67	normal	77,9%
	21	alta	22,1%
	0	baja	0%

variable	n	type	result*
femoral trochlea	18	normal	21%
	44	A	51,2%
	21	B	24,4%
	3	C	3,4%
	0	D	0%
femoral trochlea	62	normal/A	72,1%
	24	B/C	27,9%

* mean, standard deviation, frequency

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funcional results

NO recurrences!

All patients were better at final follow-up.

Kujala

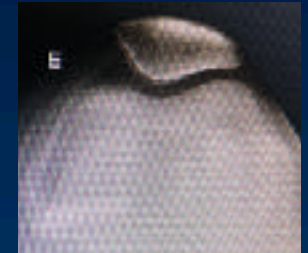
	scores	n	results
Kujala	25-100	86	77,7 ± 18,2
Kujala	poor	16	18,6%
	regular	27	31,4%
	good	28	32,5%
	excellent	15	17,5%

patellofemoral OA results

absent (72 knees)

X

grades 1,2,3 (14 knees)



patellofemoral OA	%
absent	83,7
grade 1	11,6
grade 2	3,5
grade 3	1,2
grade 4	0



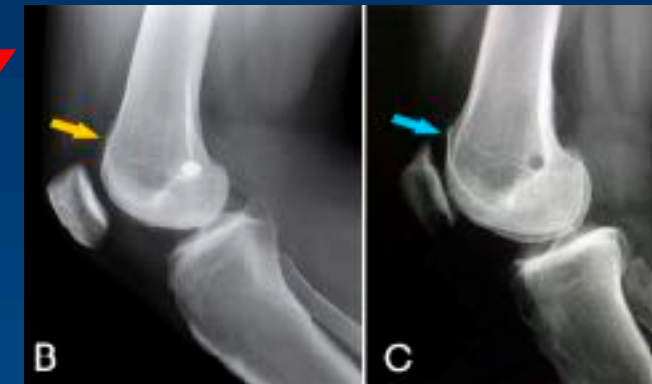
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Kujala: multivariate analysis

variable	p*
age (years)	0,890
gender	0,099
follow-up (months)	0,043
patellar height	0,310
pre-existing chondral lesion	0,495
femoral trochlea (0/A x B/C)	0,022
femoral tunnel (good = 1)	0,128
femoral tunnel (excellent = 1)	0,654
patellofemoral OA (0 x 1,2,3)	0,936

positive correlation

negative correlation



*multiple linear regression $P < 0.05$



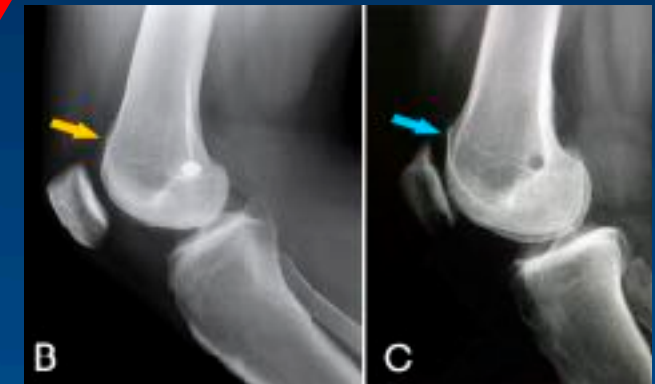
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patellofemoral OA: multivariate analysis

variable	p*
age (years)	0,175
gender	0,623
follow-up (months)	0,994
patellar height	0,601
pre-existent chondral lesions	0,906
femoral trochlea (0/A x B/C)	0,004
femoral tunnel (good X poor)	0,151
femoral tunnel (excellent X poor)	0,372
femoral tunnel(excellent X good)	0,428



negative correlation



* logistic regression $P < 0.05$



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Conclusions

- Simple technique with no recurrences and low rate of patellofemoral OA in the medium and long-terms: 16,3% (only 4,7% grades 2 and 3, and no grade 4 by Iwano's classification).
- High-grades of trochlear dysplasia (B/C) did correlate to patellofemoral OA development.

REFERENCES

1. Berruto M, Uboldi FM, Ferrua P, Vergottini G, Manunta A. Surgical treatment of objective patellar instability: long-term results. *Joints*. 2018;6(1):33-36.
2. Blanke F, Watermann K, Haenle M, Feitenhansl A, Camathias C, Vogt S. Isolated medial patellofemoral ligament reconstruction can be an effective procedure in patellofemoral instability with risk factors. *J Knee Surg*. 2019.
3. Bollier M, Fulkerson J, Cosgarea A, Tanaka M. Technical failure of medial patellofemoral ligament reconstruction. *Arthroscopy*. 2011;27(8):1153-9.
4. Camanho GL, Bitar AC, Hernandez AJ, Olivi R. Medial patellofemoral ligament reconstruction: a novel technique using the patellar ligament. *Arthroscopy*. 2007; 23(1):108.e1-4.
5. Camanho GL, Viegas AC, Bitar AC, Demange MK, Hernandez AJ. Conservative versus surgical treatment for repair of the medial patellofemoral ligament in acute dislocations of the patella. *Arthroscopy*. 2009;25(6):620-5.
6. Caton J, Deschamps G, Chambat P, Lerat JL, Dejour H. [Patella infera. Apropos of 128 cases]. *Rev Chir Orthop Reparatrice Appar Mot*. 1982;68(5):317-25.
7. Deie M, Ochi M, Sumen Y, Adachi N, Kobayashi K, Yasumoto M. A long-term follow-up study after medial patellofemoral ligament reconstruction using the transferred semitendinosus tendon for patellar dislocation. *Knee Surg Sports Traumatol Arthrosc*. 2005;13(7):522-8.
8. Dejour D, Saggin P. The sulcus deepening trochleoplasty-the Lyon's procedure. *Int Orthop*. 2010;34(2):311-6.
9. Elias JJ, Cosgarea AJ. Technical errors during medial patellofemoral ligament reconstruction could overload medial patellofemoral cartilage: a computational analysis. *Am J Sports Med*. 2006;34(9):1478-85.
10. Farr S, Huyer D, Sadoghi P, Kaipel M, Grill F, Ganger R. Prevalence of osteoarthritis and clinical results after the Elmslie-Trillat procedure: a retrospective long-term follow-up. *Int Orthop*. 2014;38(1):61-6.
11. Fithian DC, Paxton EW, Stone ML, Silva P, Davis DK, Elias DA, White LM. Epidemiology and natural history of acute patellar dislocation. *Am J Sports Med*. 2004;32(5):1114-21.
12. Gobbi RG, Demange MK, de Ávila LFR, Araújo Filho JAB, Moreno RA, Gutierrez MA, de Sá Rebelo M, Tírico LEP, Pécora JR, Camanho GL. Patellar tracking after isolated medial patellofemoral ligament reconstruction: dynamic evaluation using computed tomography. *Knee Surg Sports Traumatol Arthrosc*. 2017;25(10):3197-3205.
13. Gobbi RG, Pereira CA, Sadigursky D, Demange MK, Tírico LE, Pécora JR, Camanho GL. Evaluation of the isometry of different points of the patella and femur for medial patellofemoral ligament reconstruction. *Clin Biomech (Bristol, Avon)*. 2016;38:8-12.
14. Hiemstra LA, Kerslake S. Age at time of surgery but not sex is related to outcomes after medial patellofemoral ligament reconstruction. *Am J Sports Med*. 2019;47(7):1638-1644.
15. Hiemstra LA, Kerslake S, Lafave M. Medial patellofemoral ligament reconstruction femoral tunnel accuracy: relationship to disease-specific quality of life. *Orthop J Sports Med*. 2017a;5(2):2325967116687749.
16. Hiemstra LA, Kerslake S, Lafave MR. Quality-of-life outcomes of patients following patellofemoral stabilization surgery: the influence of trochlear dysplasia. *J Knee Surg*. 2017b;30(9):887-893.
17. Hiemstra LA, Kerslake SA, Lafave MR. Influence of risky pathoanatomy and demographic factors on clinical outcomes after isolated medial patellofemoral ligament reconstruction: a regression analysis. *Am J Sports Med*. 2019;47(12):2904-2909.
18. Hinckel BB, Gobbi RG, Demange MK, Pereira CAM, Pécora JR, Natalino RJM, Miyahira L, Kubota BS, Camanho GL. Medial patellofemoral ligament, medial patellotibial ligament, and medial patellomeniscal ligament: anatomic, histologic, radiographic, and biomechanical study. *Arthroscopy*. 2017;33(10):1862-1873.
19. Hinckel BB, Gobbi RG, Kaleka CC, Camanho GL, Arendt EA. Medial patellotibial ligament and medial patellomeniscal ligament: anatomy, imaging, biomechanics, and clinical review. *Knee Surg Sports Traumatol Arthrosc*. 2018;26(3):685-696.
20. Hopper GP, Leach WJ, Rooney BP, Walker CR, Blyth MJ. Does degree of trochlear dysplasia and position of femoral tunnel influence outcome after medial patellofemoral ligament reconstruction? *Am J Sports Med*. 2014;42(3):716-22.
21. Howells NR, Barnett AJ, Ahearn N, Ansari A, Eldridge JD. Medial patellofemoral ligament reconstruction: a prospective outcome assessment of a large single centre series. *J Bone Joint Surg Br*. 2012;94(9):1202-8.
22. Iwano T, Kurosawa H, Tokuyama H, Hoshikawa Y. Roentgenographic and clinical findings of patellofemoral osteoarthritis. With special reference to its relationship to femorotibial osteoarthritis and etiologic factors. *Clin Orthop Relat Res*. 1990;(252):190-7.
23. Juliusson R, Markhed G. A modified Hauser procedure for recurrent dislocation of the patella. A long-term follow-up study with special reference to osteoarthritis. *Arch Orthop Trauma Surg*. 1984;103(1):42-6.
24. Kujala UM, Jaakkola LH, Koskinen SK, Taimela S, Hurme M, Nelimarkka O. Scoring of patellofemoral disorders. *Arthroscopy*. 1999;9(2):159-63.
25. Lewallen L, McIntosh A, Dahm D. First-time patellofemoral dislocation: risk factors for recurrent instability. *J Knee Surg*. 2015;28(4):303-9.
26. Marcacci M, Zaffagnini S, Iacono F, Visani A, Petitto A, Neri NP. Results in the treatment of recurrent dislocation of the patella after 30 years' follow-up. *Knee Surg Sports Traumatol Arthrosc*. 1995;3(3):163-6.
27. McCarthy M, Ridley TJ, Bollier M, Wolf B, Albright J, Amendola A. Femoral tunnel placement in medial patellofemoral ligament reconstruction. *Iowa Orthop J*. 2013;33:58-63.
28. Mountney J, Senavongse W, Amis AA, Thomas NP. Tensile strength of the medial patellofemoral ligament before and after repair or reconstruction. *J Bone Joint Surg Br*. 2005;87(1):36-40.
29. Mäenpää H, Lehto MU. Patellar dislocation: the long-term results of nonoperative management in 100 patients. *Am J Sports Med*. 1997;25(2):213-7.
30. Nomura E, Inoue M. Surgical technique and rationale for medial patellofemoral ligament reconstruction for recurrent patellar dislocation. *Arthroscopy*. 2003;19(5):E47.
31. Nomura E, Inoue M, Kobayashi S. Long-term follow-up and knee osteoarthritis change after medial patellofemoral ligament reconstruction for recurrent patellar dislocation. *Am J Sports Med*. 2007;35(11):1851-8.
32. Outerbridge RE. The etiology of chondromalacia patellae. *J Bone Joint Surg Br*. 1961;43-B:752-7.
33. Placella G, Tei M, Sebastiani E, Speziali A, Antinolfi P, Delcogliano M, Georgoulis A, Cerulli G. Anatomy of the medial patello-femoral ligament: a systematic review of the last 20 years literature. *Musculoskelet Surg*. 2015;99(2):93-103.
34. Placella G, Tei MM, Sebastiani E, Criscenti G, Speziali A, Mazzola C, Georgoulis A, Cerulli G. Shape and size of the medial patellofemoral ligament for the best surgical reconstruction: a human cadaveric study. *Knee Surg Sports Traumatol Arthrosc*. 2014; 22(10):2327-33.
35. Rouanet T, Gougeon F, Fayard JM, Rémy F, Migaud H, Pasquier G. Sulcus deepening trochleoplasty for patellofemoral instability: A series of 34 cases after 15 years postoperative follow-up.: *Orthopaedics & Traumatology: Surgery & Research*. 2015;443-7.
36. Sallay PI, Poggi J, Speer KP, Garrett WE. Acute dislocation of the patella. A correlative pathoanatomic study. *Am J Sports Med*. 1996;24(1):52-60.
37. Salonen EE, Magga T, Sillanpää PJ, Kiekara T, Mäenpää H, Mattila VM. Traumatic patellar dislocation and cartilage injury: a follow-up study of long-term cartilage deterioration. *Am J Sports Med*. 2017;45(6):1376-1382.
38. Sanchis-Alfonso V. Guidelines for medial patellofemoral ligament reconstruction in chronic lateral patellar instability. *J Am Acad Orthop Surg*. 2014;22(3):175-82.
39. 'Sappey-Mariniere E, Sonnery-Cottet B, O'Loughlin P, Ouanezar H, Reina Fernandes L, Kouevidijn B, Thauant M. Clinical outcomes and predictive factors for failure with isolated MPFL reconstruction for recurrent patellar instability: a series of 211 reconstructions with a minimum follow-up of 3 years. *Am J Sports Med*. 2019;47(6):1323-1330.
40. Schorn D, Yang-Strathoff S, Goshager G, Vogler T, Klingebiel S, Rickert C, Andreou D, Liem D. Long-term outcomes after combined arthroscopic medial reefing and lateral release in patients with recurrent patellar instability - a retrospective analysis. *BMC Musculoskelet Disord*. 2017;18(1):277.
41. Schöttle PB, Fucente SF, Romero J. Clinical and radiological outcome of medial patellofemoral ligament reconstruction with a semitendinosus autograft for patella instability. *Knee Surg Sports Traumatol Arthrosc*. 2005;13(7):516-21.
42. Schöttle PB, Schmeling A, Rosenstiel N, Weiler A. Radiographic landmarks for femoral tunnel placement in medial patellofemoral ligament reconstruction. *Am J Sports Med*. 2007;35(5):801-4.
43. Schüttler KF, Struwer J, Roessler PP, Gesslein M, Rominger MB, Ziring E, Efe T. Patellofemoral osteoarthritis after Insall's proximal realignment for recurrent patellar dislocation. *Knee Surg Sports Traumatol Arthrosc*. 2014;22(11):2623-8.
44. Scuderi G, Cuomo F, Scott WN. Lateral release and proximal realignment for patellar subluxation and dislocation. A long-term follow-up. *J Bone Joint Surg Am*. 1988;70(6):856-61.
45. Servien E, Fritsch B, Lustig S, Demey G, Debarge R, Lapra C, Neyret P. In vivo positioning analysis of medial patellofemoral ligament reconstruction. *Am J Sports Med*. 2011;39(1):134-9.
46. Sillanpää P, Mattila VM, Visuri T, Mäenpää H, Pihlajamäki H. Ligament reconstruction versus distal realignment for patellar dislocation. *Clin Orthop Relat Res*. 2008;466(6):1475-84.
47. Sillanpää PJ, Mattila VM, Visuri T, Mäenpää H, Pihlajamäki H. Patellofemoral osteoarthritis in patients with operative treatment for patellar dislocation: a magnetic resonance-based analysis. *Knee Surg Sports Traumatol Arthrosc*. 2011;19(2):230-5.
48. Steensen RN, Dopirak RM, McDonald WG. The anatomy and isometry of the medial patellofemoral ligament: implications for reconstruction. *Am J Sports Med*. 2004;32(6):1509-13.
49. Steiner TM, Torga-Spak R, Teitge RA. Medial patellofemoral ligament reconstruction in patients with lateral patellar instability and trochlear dysplasia. *Am J Sports Med*. 2006;34(8):1254-61.
50. Stupay KL, Swart E, Shubin Stein BE. Widespread implementation of medial patellofemoral ligament reconstruction for recurrent patellar instability maintains functional outcomes at midterm to long-term follow-up while decreasing complication rates: a systematic review. *Arthroscopy*. 2015;31(7):1372-80.
51. Testa EA, Camathias C, Amsler F, Henle P, Friederich NF, Hirschmann MT. Surgical treatment of patellofemoral instability using trochleoplasty or MPFL reconstruction: a systematic review. *Knee Surg Sports Traumatol Arthrosc*. 2017;25(8):2309-2320.
52. Thauant M, Erasmus PJ. The favourable anisometry: an original concept for medial patellofemoral ligament reconstruction. *Knee*. 2007;14(6):424-8.
53. Tompkins MA, Arendt EA. Patellar instability factors in isolated medial patellofemoral ligament reconstructions--what does the literature tell us? A systematic review. *Am J Sports Med*. 2015;43(9):2318-27.
54. Tscholl PM, Ernstbrunner L, Pedrazzoli L, Fucente SF. The relationship of femoral tunnel positioning in medial patellofemoral ligament reconstruction on clinical outcome and postoperative complications. *Arthroscopy*. 2018;34(8):2410-2416.
55. van Sambeek JDP, van de Groen SAW, Verdonchot N, Hannink G. Trochleoplasty procedures show complication rates similar to other patellar-stabilizing procedures. *Knee Surg Sports Traumatol Arthrosc*. 2018;26(9):2841-2857.
56. Vivod G, Verdonk P, Drobnic M. Long-term clinical and radiographic outcome of patello-femoral realignment procedures: a minimum of 15-year follow-up. *Knee Surg Sports Traumatol Arthrosc*. 2014;22(11):2747-55.
57. Witoński D, Kęska R, Synder M, Sibiński M. An isolated medial patellofemoral ligament reconstruction with patellar tendon autograft. *Biomed Res Int*. 2013;637-678.
58. Woodmass JM, Johnson NR, Cates RA, Krych AJ, Stuart MJ, Dahm DL. Medial patellofemoral ligament reconstruction reduces radiographic measures of patella alta in adults. *Orthop J Sports Med*. 2018;6(1):2325967117751659.
59. Zhang L, Li Z. Long-term clinical results of double bundle reconstruction of the medial patellofemoral ligament for patellar instability. *J Knee Surg*. 2018;32(2):153-59.

