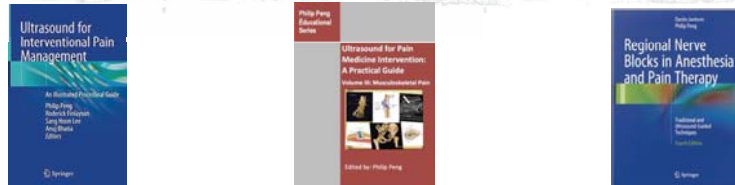


Non-surgical Intervention for Knee Osteoarthritis: From Injection to Denervation



EQUIPMENT SUPPORT FROM SONOSITE FUJIFILM CANADA



Osteoarthritis

- most common type of arthritis
- OA hip and knee ranked 11th highest contributor to global disability ¹
- Prevalence of symptomatic OA knee in individuals ≥ 45 y.o. $\sim 16.7\%$ in US²
- Management strategies³
 - pharmacologic treatments, physical therapy
 - interventional techniques
 - Surgery



1. Cross M, et al. Ann Rheum Dis. 2014;73:1323;
2. Barbour et al. Arthritis Care & Research in Press;
3. Nelson AE et al. Semin Arthritis Rheum 2014;43:701

Interventional Procedures

Modality	Proposed mechanism
IA steroid	Anti-inflammatory
Viscosupplement	Supplementation of synovial fluid
Platelet rich plasma	Restore joint hemostasis

Corticosteroid

3 systematic reviews consistently concluded

- IA corticosteroid > IA placebo for pain reduction (WMD - 21.91; 95% CI -29.93 to -13.89)
- patient global assessment (RR- 1.44; 95% CI 1.13 to 1.82).
- only short-term benefit (< 3 weeks)
- a lack of evidence for efficacy in functional improvement.



Pain Medicine 2012; 13: 740-753
Wiley Periodicals, Inc.

REVIEW ARTICLES

Evidence-Based Knee Injections for the Management of Arthritis

Olivia T. Cheng, BA, Dmitri Souzdalitski, MD, Bruce Wootman, MD, and Jianguo Cheng, MD, PhD

Conclusions. We conclude that strong evidence supports the use of intraarticular knee injection as a cost-effective intervention in the management of knee

JAMA | Original Investigation

Effect of Intra-articular Triamcinolone vs Saline on Knee Cartilage Volume and Pain in Patients With Knee Osteoarthritis A Randomized Clinical Trial

JAMA. 2017;317(19):1967-1975

Timothy E. McAlindon, DM, MPH; Michael P. LaValley, PhD; William F. Harvey, MD; Lori Lyn Price, MAS; Jeffrey B. Driban, PhD; Ming Zhang, PhD; Robert J. Ward, MD

Repeated injection (every 3 months) x 2years
Cartilage loss
0.11mm in thickness loss cf saline group

Table 2. Treatment Effect on Structural Outcomes of Knees With Osteoarthritis*

Measurement	Mean (95% CI) Triamcinolone (n = 78)		Saline (n = 78)		Between-Group Difference in Change	P Value
	Baseline	2-Year Change	Baseline	2-Year Change		
Cartilage thickness, mm						
Intra-compartment	2.43 (2.37 to 2.50)	-0.21 (-0.29 to -0.14)	2.34 (2.19 to 2.50)	-0.30 (-0.36 to -0.24)	-0.11 (-0.20 to -0.03)	.01
Total knee cartilage thickness	3.98 (3.95 to 3.99)	-0.20 (-0.19 to -0.19)	3.61 (3.59 to 3.64)	-0.13 (-0.13 to -0.03)	-0.16 (-0.19 to -0.03)	.001
Cartilage damage index, mean**						
Intra-compartment	973.56 (885.78 to 1061.34)	-131.66 (-177.39 to -85.93)	884.60 (917.49 to 1062.70)	-72.41 (-114.58 to -30.24)	-61.25 (-121.39 to -1.12)	.043
Total	2664.79 (2482.51 to 2826.67)	-177.61 (-257.25 to -88.00)	2678.41 (2508.21 to 2848.67)	-82.01 (-145.42 to -18.60)	-64.42 (-104.01 to -24.84)	.006

*Data are presented as mean (95% CI).

**Data are presented as mean (95% CI).

Viscosupplement

- 7 systematic reviews, 9/10 guidelines positive on HA
- Cf. placebo, a significant improvement in pain scores from baseline by 26% and function by 27% during the period of fifth to thirteenth week



Pain Medicine 2012; 13: 740-753
Wiley Periodicals, Inc.

REVIEW ARTICLES

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Conclusions. We conclude that strong evidence supports the use of intraarticular knee injection as a cost-effective intervention in the management of knee



AAOS statement



- 7 additional trials
- Excluded studies <30 patient or efficacy <4 weeks
- “minimum clinically important improvement (MCII)”
- Statistical vs. clinical significance.
- Strong recommendation AGAINST use of VS

Review Article

Viscosupplementation for treating knee osteoarthritis: review of the literature¹

Tiago Youssef Ammar, Tomas Araujo Prado Pereira, Saulo Luis Lopes Mistura, André Kuhn, José Idílio Saggin, Osmar Valadão Lopes Júnior*

Instituto de Ortopedia e Traumatologia de Passo Fundo, Passo Fundo, RS, Brazil

study included analysis on randomized clinical trials that included at least 100 patients in each intervention group, meta-analyses and systematic reviews. Two meta-analyses, five systematic reviews and six randomized clinical trials fulfilled the inclusion criteria for this

study included analysis on randomized clinical trials that included at least 100 patients in each intervention group, meta-analyses and systematic reviews. Two meta-analyses, five systematic reviews and six randomized clinical trials fulfilled the inclusion criteria for this review. In the light of the best evidence available so far, there is no consensus for indicating or even for contraindicating the use of intra-articular viscosupplementation among patients with symptomatic knee osteoarthritis (level of evidence I and degree of recommendation A). Further studies with appropriate methodology are needed to elucidate this matter.

Platelet Rich Plasma

- Growth factors and cytokines
- Regenerative functions
 - Proliferation of stem cells and their recruitment
 - Modulate inflammation
 - Simulate new vessel formation



RESEARCH ARTICLE

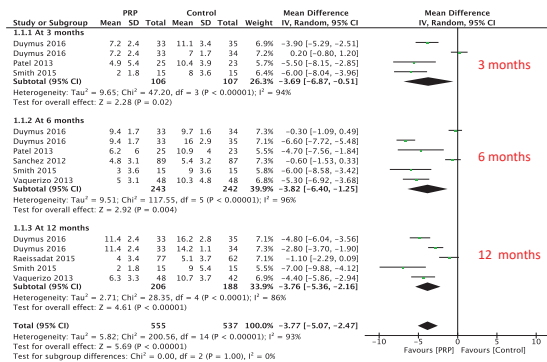
The temporal effect of platelet-rich plasma on pain and physical function in treatment of knee osteoarthritis: review and meta-analysis of randomized controlled trials

Longxiang Shen¹, Ting Yuan^{1†}, Shengbao Chen², Xuetao Xie^{1*} and Chang...

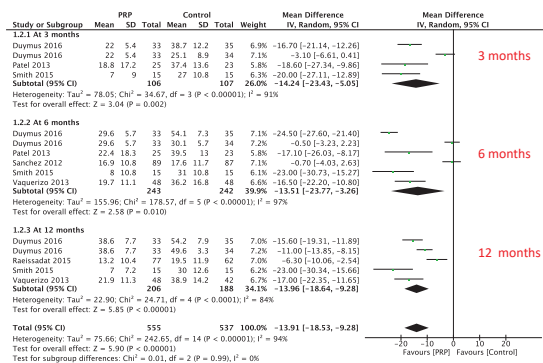
14 RCT, 1423 participants
Risk of bias: moderate in 4, high in



WOMAC Pain score



WOMAC Pain score



Orthop J Sports Med. 2017 Feb 13;5(2):2325967116689386. doi: 10.1177/2325967116689386. eCollection 2017 Feb.

Platelet-Rich Plasma Injections for Advanced Knee Osteoarthritis: A Prospective, Randomized, Double-Blinded Clinical Trial.

Joseph Aubert N¹, Rodriguez L², Beverik-Vinuesa MM³, Navarro A³

Intervention: PRP single injection vs. Bupi/betamethasone

Population: KL grade 3 and 4

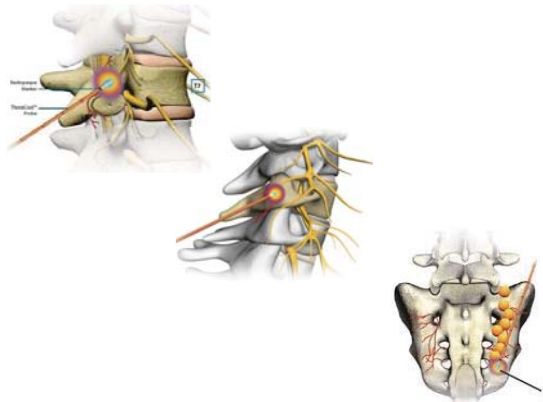
Outcomes: Primary endpoint VAS at 1, 3 and 6 months

Result:

- No difference between IACS and PRP
- SF 36 and quality of life indicators at 6 months improve more in PRP group vs. IACS



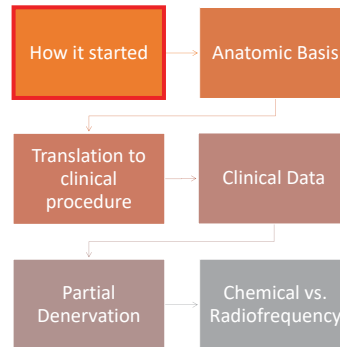
In patient with advanced knee OA, what is the alternative to knee replacement?





How it started


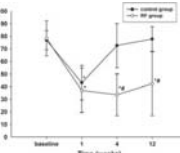
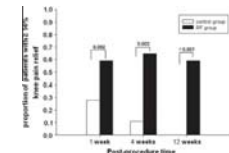
Areas to cover

Areas to cover





 PAIN[®] 152 (2011) 481–487

Research paper
Radiofrequency treatment relieves chronic knee osteoarthritis pain: A double-blind randomized controlled trial
 Woo-Jong Choi¹, Seung-Jun Hwang², Jun-God Song³, Jeong-Gil Leem⁴, Yong-Up Kang⁵, Pyong-Hwan Park⁶, Jin-Woo Shim^{7*}

OKS (12–60 points)	Control group	RF group	P
1 week	26.8 ± 4.5	23.6 ± 7.5	12.4 ± 4.3
4 weeks	36.9 ± 3.5	25.8 ± 8.0	2.3 ± 4.8
12 weeks	38.5 ± 4.9	27.4 ± 10.2	0.3 ± 1.3

Proportion of patients with pain relief	Control group	RF group	P
1 week	0.33	0.67	0.296
4 weeks	0.33	0.67	14.1 ± 9.7*
12 weeks	0.33	0.67	12.4 ± 10.7*

Patient satisfaction with GPE [†]	Control group	RF group	P
1 week	5.3 ± 0.8	5.5 ± 0.7	0.457
4 weeks	4.3 ± 0.8	5.9 ± 0.9 [‡]	<0.001
12 weeks	3.7 ± 0.5	5.5 ± 1.1 [‡]	<0.001

Areas to cover

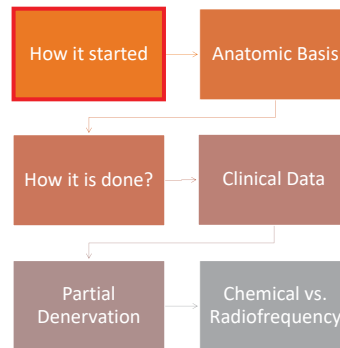
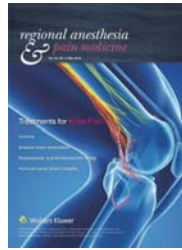


Table 1. Previous Cadaveric Studies of the Innervation of the Anterior Knee Joint

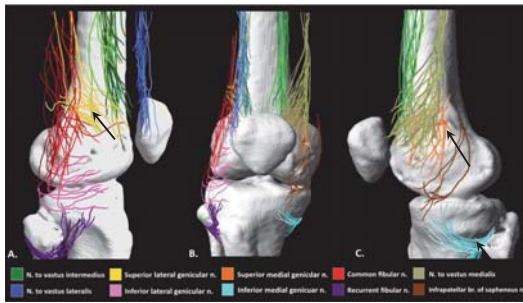
	Superior lateral genicular	Inferior lateral genicular	Superior medial genicular	Inferior medial genicular	Common fibular	Recurrent fibular	Saphenous	N. to vastus lateralis	N. to vastus intermedius	N. to vastus medialis
Cooper ¹⁶ 1948 (n=11)	✓	✓	3/11	✓	10/11	11/11	✓	✓	✓	✓
Kennedy et al ¹⁷ 1982 (n=15)	x	✓ _a	x	x	x	✓	✓	✓	✓	✓
Horner et al ¹⁸ 1994 (n=45)	✓	✓ _a	x	x	x	✓	45/45	x	45/45	45/45
Hiracawa et al ¹⁹ 2000 (n=5)	✓ _b	✓ _b	✓ _b	x	✓	x	✓	✓	x	✓
Franso et al ²⁰ 2015 (n=8)	x	x	x	x	8/8 _c	8/8	8/8	8/8	8/8 _d	8/8
Kalbar et al ²¹ 2015 (n=32)	NI	NI	NI	NI	NI	NI	32/32	NI	NI	NI
Yasar et al ²² 2015 (n=10)	NI	NI	10/10	10/10	NI	NI	NI	NI	NI	NI
Burckett-St Lasarant et al ²³ 2016 (n=20)	NI	NI	18/20	x	NI	NI	11/20	NI	NI	20/20
Orduşovalı et al ²⁴ 2017 (n=25)	x	x	x	x	25/25 _c	8/25	25/25	25/25	25/25	25/25
Sataria et al ²⁵ 2017 (n=20)	✓	NI	NI	NI	✓ _c	NI	NI	NI	NI	NI

a, lateral articular nerve; b, followed the popliteal vessels; c, lateral retinacular nerve; d, medial retinacular branch; n, specimens; NI, not investigated; x, not found.

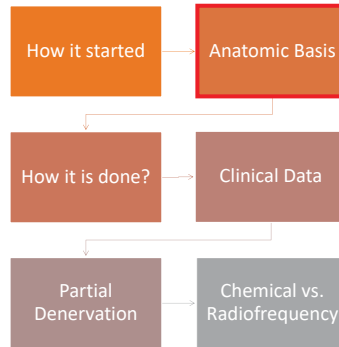


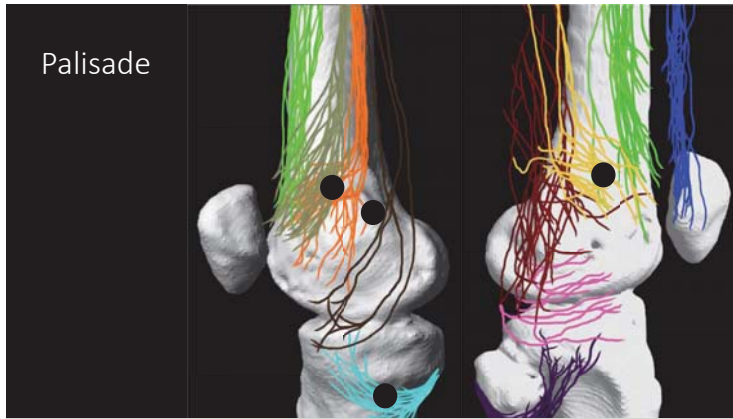
Anatomical Study of the Innervation of Anterior Knee Joint Capsule
Implication for Image-Guided Intervention

John Tran, HBSc,* Philip W.H. Fong, MBBS,† Karen Lam, MD,‡ Ehsanum Baig, MD,‡
Anne M.R. Agre, PhD,* and Michael Gofçal, MD†

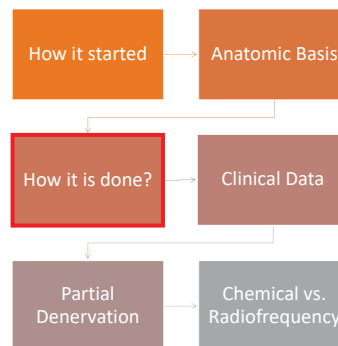


Areas to cover





Areas to cover



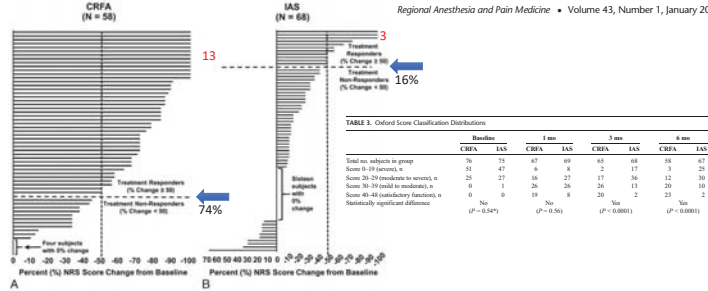
Radiofrequency Procedures to Relieve Chronic Knee Pain
An Evidence-Based Narrative Review

Anuj Bhatia, MBBS, MD, FRCA, FRCP, FIPP, FFPARC, EDRA, CIPS,*
Philip Peng, MBBS, FRCP,† and Steven P. Cohen, MD,‡
Regional Anesthesia and Pain Medicine • Volume 41, Number 4, July-August 2016

Prospective, Multicenter, Randomized, Crossover Clinical Trial Comparing the Safety and Effectiveness of Cooled Radiofrequency Ablation With Corticosteroid Injection in the Management of Knee Pain From Osteoarthritis

Tim Davis, MD,* Eric Loudermilk, MD,† Michael DePalma, MD,‡ Corey Hunter, MD,§ David Lindley, DO,||
Vishal Ford, MD,** Daniel Choi, MD,†† Marc Solomon, MD,†† Anita Gupta, DO,‡‡PharmD,§§
Mehul Desai, MD,||| Asokumar Buvanendran, MD,** and Leonardo Kapural, MD, PhD†††

Regional Anesthesia and Pain Medicine • Volume 43, Number 1, January 2018



Systematic Review and Meta-Analysis of 12 Randomized Controlled Trials Evaluating the Efficacy of Invasive Radiofrequency Treatment for Knee Pain and Function

BioMed Research International
Volume 2019, Article ID 9037510, 14 pages
Tao Hong,¹ Haiyuan Wang,² Guangxiao Li,³ Peng Yao,³ and Yuanyuan Ding¹

Genicular nerve ablation: a systematic review of procedure outcomes for chronic knee pain

Lauren Zellinger, DO, Judith Kopinski, MD and Thomas DiPasquale, DO

Current Orthopaedic Practice
Volume 30 • Number 5 • September/October 2019

Systematic Review of Radiofrequency Ablation for Management of Knee Pain

Current Pain and Headache Reports (2019) 23:55

Vwaire Othuru¹, Ivan Urits¹, Ravi Grandhi², Alaa Abd-Elkayed³

NEUROMODULATION & INTERVENTIONAL SECTION

Radiofrequency Procedures for the Treatment of Symptomatic Knee Osteoarthritis: A Systematic Review

Prabjit Alrajwat, H.B.Kin,* Lemmy Radomski, MD,* Anuj Bhatia, MD, MBBS, FRCA, FRCP,†,§,§
Philip Peng, MBBS, FRCP,† Nikhil Nath,** and Rajiv Gandhi, MD, MSc, FRCS*

Pain Medicine, 21(2), 2020, 333-348

The Effectiveness and Safety of Genicular Nerve Radiofrequency Ablation for the Treatment of Recalcitrant Knee Pain Due to Osteoarthritis: a Comprehensive Literature Review

Quinn Tate¹, Aaron Conger¹, Taylor Burnham¹, Daniel M. Cushman¹, Richard Kendall¹, Byron Schneider², Zachary L. McCormick³

Current Physical Medicine and Rehabilitation Reports (2019) 7:404-413

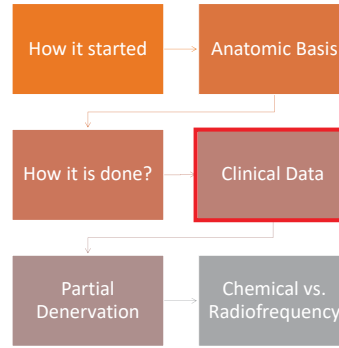
13 RCT, 2 PC, 7P, 11 case series



Areas that is not clear



Areas to cover



Charcot joint



- Systemic disease
- Affect both nervous and vascular system

Partial Denervation

RECONSTRUCTIVE

Partial Joint Denervation I: Wrist, Shoulder, and Elbow

A. Lee Delton, M.D., Ph.D.
Bethesda, Md.

Background: Partial joint denervation is the concept of preservation of joint function and relief of joint pain by interrupting neural pathways that transmit the pain message from the joint to the brain. Partial denervation of painful wrist, elbow, and shoulder joints was described in part I. Application of these principles to the knee and ankle is described in part II.

RECONSTRUCTIVE

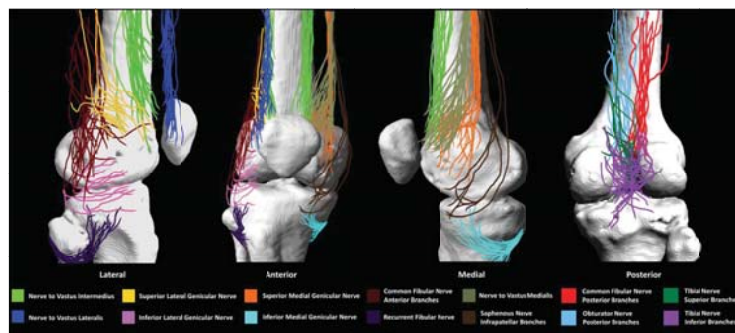
Partial Joint Denervation II: Knee and Ankle

A. Lee Delton, M.D., Ph.D.
Bethesda, Md.

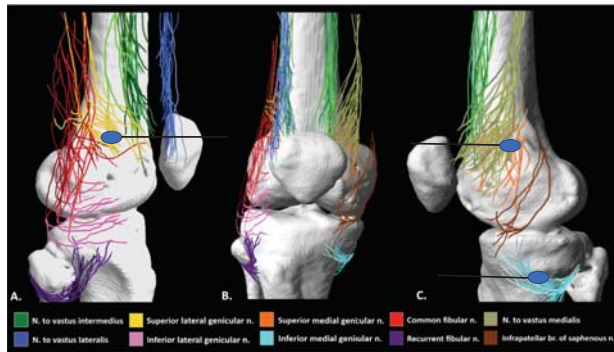
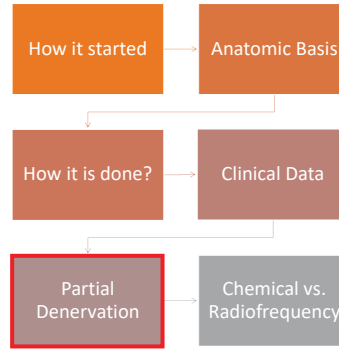
Background: Partial joint denervation is the concept of preservation of joint function and relief of joint pain by interrupting neural pathways that transmit the pain message from the joint to the brain. Partial denervation of painful wrist, elbow, and shoulder joints was described in part I. Application of these principles to the knee and ankle is described in part II.

Methods: Cadaveric anatomical studies identified innervation of the knee and the ankle (sinus tarsi) to provide a guide to nerve blocks and surgical interventions. Patients were evaluated who had sports injuries, trauma, osteoarthritis, or previous arthroscopy/scope procedures of the knee and/or ankle who failed to respond to traditional musculoskeletal approaches.

Results: The results obtained for partial joint denervation of the inner ex-




Areas to cover



ORIGINAL ARTICLE



Chemical Ablation of Genicular Nerve with Phenol for Pain Relief in Patients with Knee Osteoarthritis: A Prospective Study

Roberta Cristina Risso, MD*; Leonardo Henrique Cunha Ferraro , MD, PhD*; Thiago Nouer Frederico, MD*; Philip W. H. Peng, MBBS, FRCPC*; Marcus Vinicius Luzo, MD, PhD*; Pedro Debieux, MD, PhD*; Rioko Kimiko Sakata , MD, PhD*

*Federal University of São Paulo, São Paulo, Brazil; *Toronto Western Hospital, University of Toronto, Toronto, Ontario, Canada



Table 3. Pain Intensity (range)

Baseline (T0)	7 (6 - 8)
2wks	4 (3 - 5)*
1mos	4 (2 - 5)*
2mos	4 (3 - 5)*
3mos	4 (2 - 5)*
6mos	4 (3 - 6)*



Table 2. WOMAC SCORE-subscale and composite Pain >50% relief is 46% at 6 months

WOMAC Subscale	Baseline	2wks	1mos	2mos	3mos	6mos
Pain	9(8-13)	6(4-7)*	4(2-6)*	5(2-6)*	3(2-6)*	4(2-8)*
Stiffness	4(2-6)	1(0-3)*	1(0-2)*	1(0-2)*	0(0-2)*	0(0-2)*
Function	32(26-44)	15(11-25)*	13(9-18)*	13(7-18)*	11(7-19)*	13(9-21)*
Composite Score	45(35-62)	23(16-34)*	19(13-25)*	18(10-26)*	16(9-29)*	17(12-26)*

Table 4. Number of Patients with Side Effects and Complications

	2 weeks	1 month	2 months	3 months	6 months
Local pain	2 (5%)	0	0	0	0
Hypoesthesia	6 (14%)	0	0	0	0
Swelling	13 (30%)	5 (12%)	0	0	0
Bruise	9 (21%)	0	0	0	0

Summary

- Intra-articular injection:
 - steroid, VS, and PRP
 - efficacy and limitations
- Genicular nerves ablation
 - Anatomical basis
 - Technical aspect
 - Efficacy
 - Radiofrequency vs chemical

Thank You