State of the Art Denervation

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Proliance Hand, Wrist & Elbow Physicians
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www.ProHand.com

PROLIANCE HAND, WRIST & ELBOW PHYSICIANS
WORK AGAIN, PLAY AGAIN!

Outline

- Define the problem
- Patient identification
- Discuss the research
- PHWE case examples
- Future considerations

Define the problem

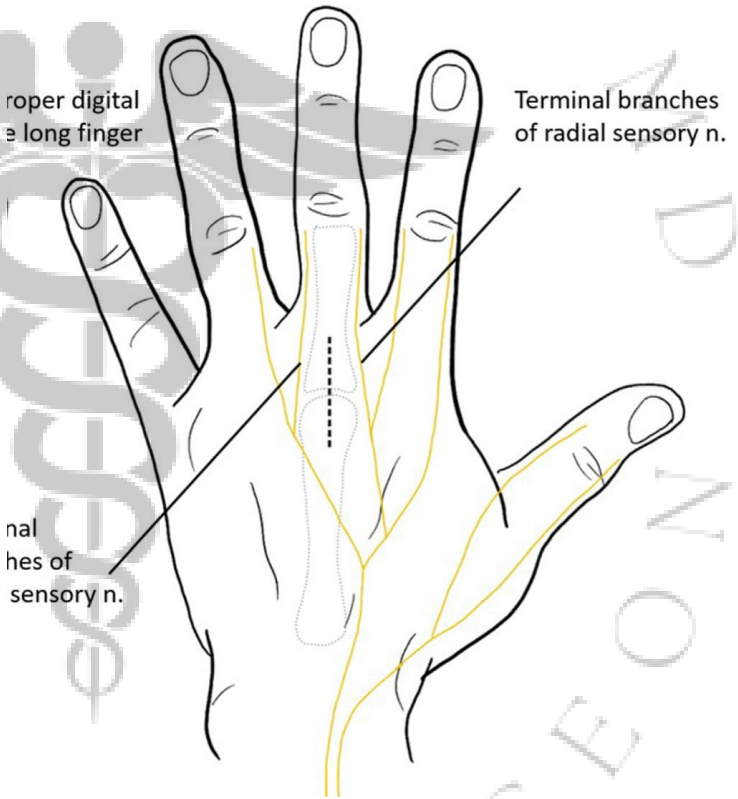
What is a denervation?

A surgeon can resect or divide the nerve branches that supply afferent sensory signals without structurally altering the underlying joint while avoiding nerve branches serving motor or cutaneous sensory targets.

Lifchez et al. Small Joint Denervation of the Hand and Thumb Base: History, Anatomy, Technique, and Outcomes J Hand Surg Am. 2024;49(6):592e601.

Define the problem

What is a dene



Lifchez et al. Small Joint Denervation of the Hand and Thumb Base: History, Anatomy, Technique, and Outcomes J Hand Surg Am. 2024;49(6):592e601.

Define the problem

What is a denervation?

Table 3-2. PRINCIPLES OF PARTIAL JOINT DENERVATION.

1. If your brain perceives pain in a joint, then that message is transmitted by a nerve

2. If the anatomy textbooks do not show nerves to a joint, then research can be done to identify those nerves. They do exist.

3. If the nerves to the joint can be found, then pain relief can be demonstrated by a local anesthetic nerve block.

4. If pain relief is possible by a nerve block of the nerve to the joint, then a surgical approach can be planned to remove that nerve.

5. If pain relief is possible by partial joint denervation, then joint function can be saved.

6. The above approach assumes that musculoskeletal structures have been restored, and the joint has structural stability.

Dellon, AL. **Pain Solutions: third edition**

Patient Identification

Google.com

Patient Identification

Mike Weir

Youtube.com

Patient Identification

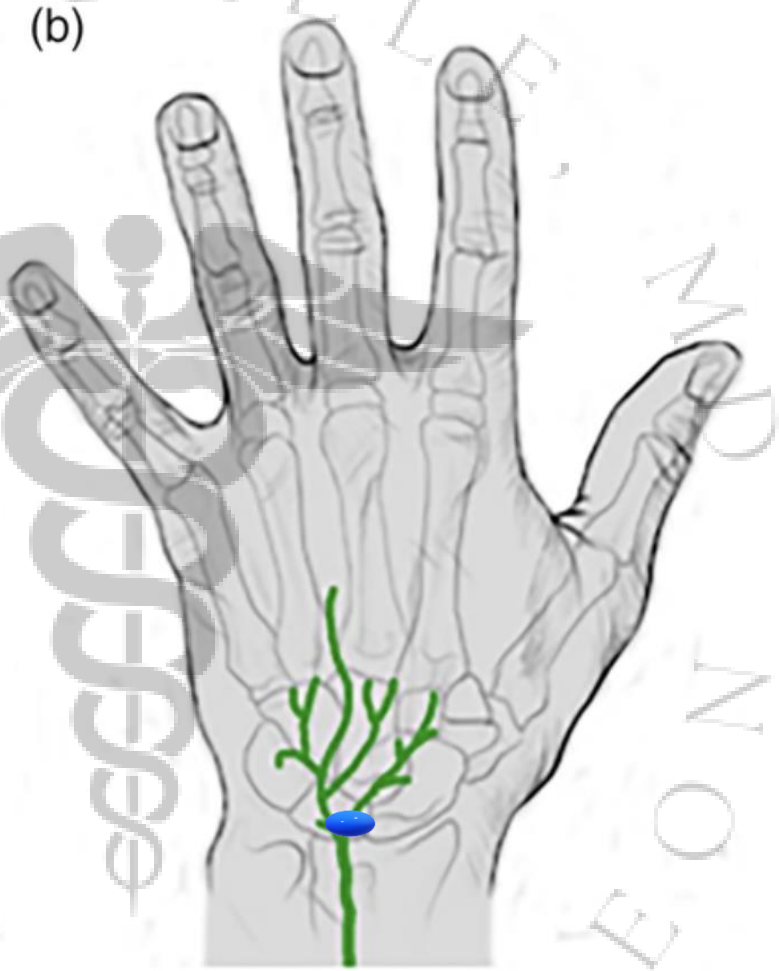
Google.com

Patient Identification

Leandro Barbosa

Youtube.com

Define the problem

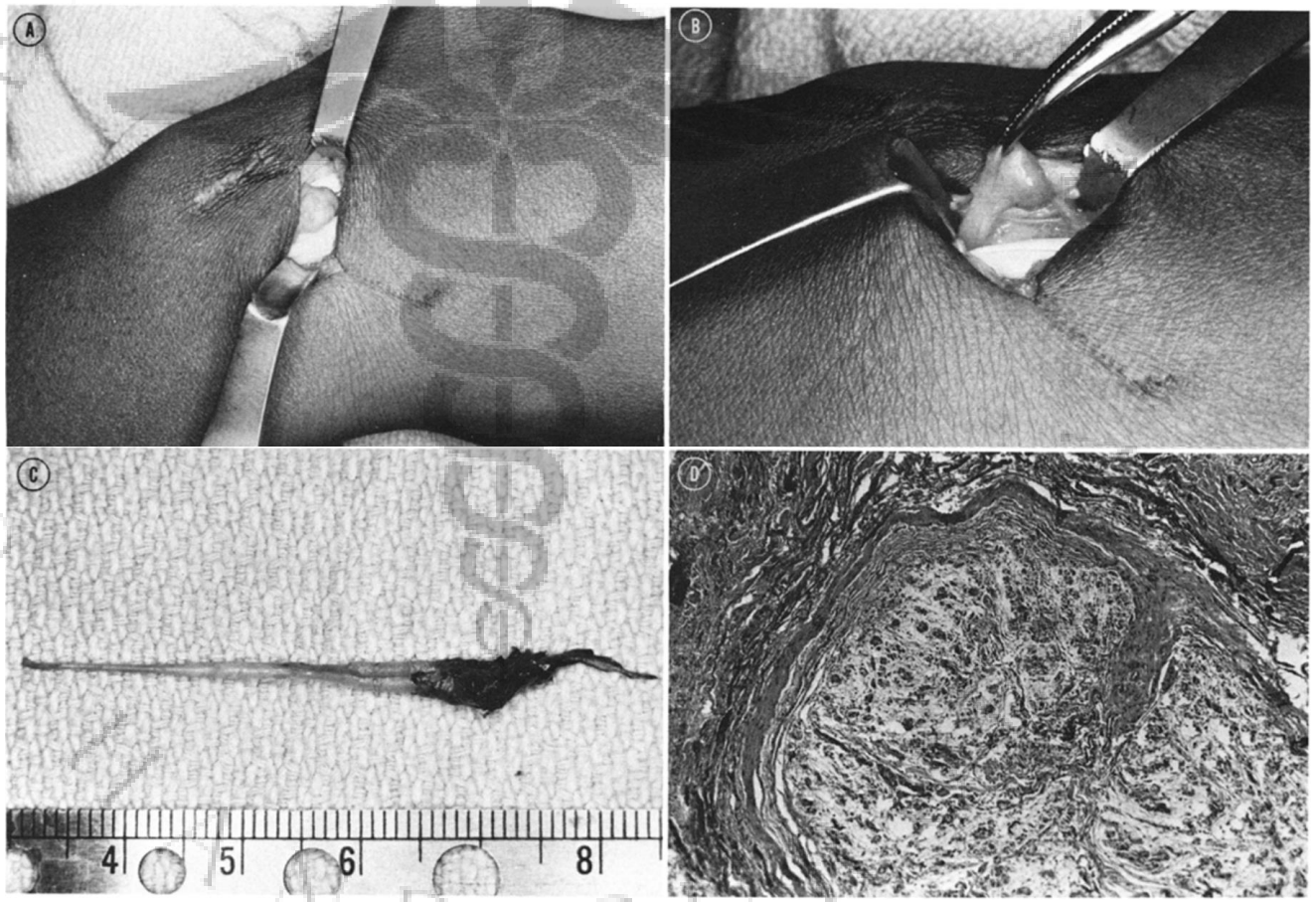


https://www.researchgate.net/figure/Branching-pattern-of-the-posterior-interosseous-nerve-in-two-representative-cases_fig3_336243612

Research

Anatomic dissections relating the posterior interosseous nerve to the carpus, and the etiology of dorsal wrist ganglion pain

A. Lee Dellon, M.D.,* *Baltimore, Md., and* Sue S. Seif, M.A.,** *Richmond, Va.*



Research

Anatomic dissections relating the posterior interosseous nerve to the carpus, and the etiology of dorsal wrist ganglion pain

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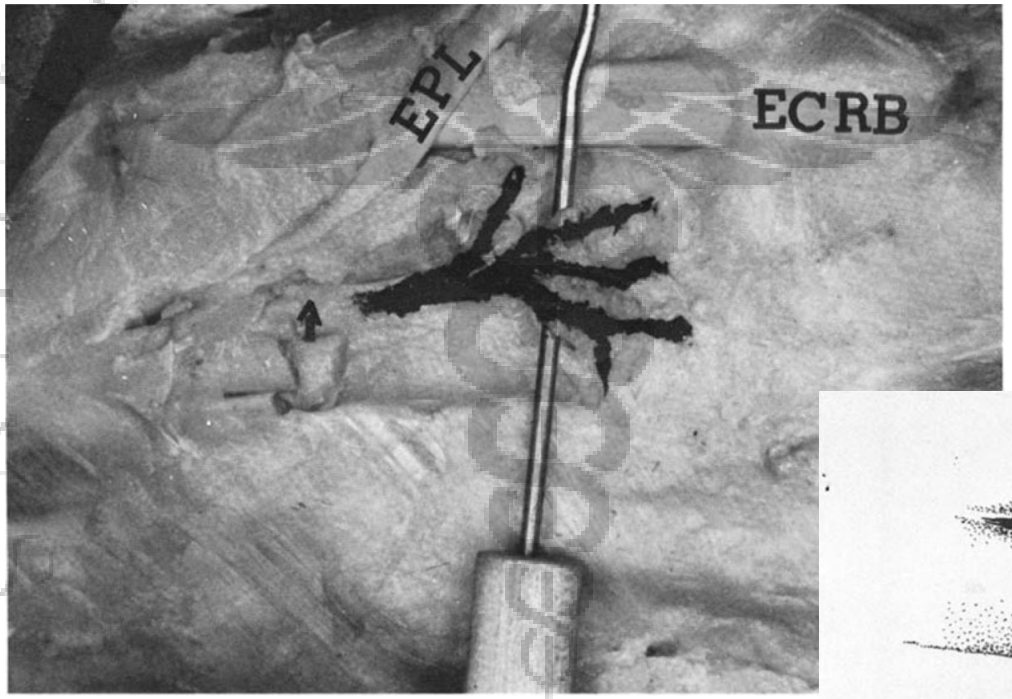
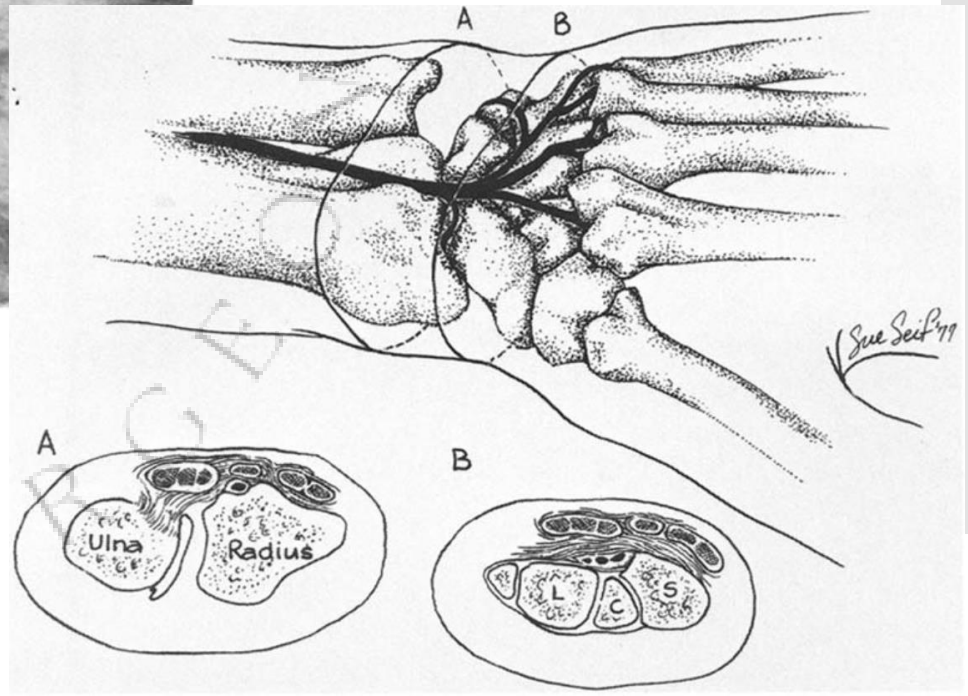


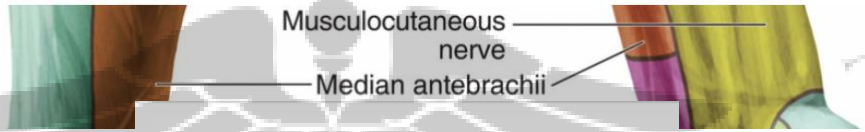


Research

State of the Art in Denervation

First described by Wilheim in 1959 for wrist arthritis
J Hand Surg Br 1996 Dec;21(6):834.

Sim



REVIEW ARTICLE

Denervation of the Wrist Joint for the Management of Chronic Pain

Kadiyala, R. Kumar MD, PhD; Lombardi, Joseph M. MD

Author Information

Journal of the American Academy of Orthopaedic Surgeons 25(6):p 439-447, June 2017. | ***DOI:*** 10.5435/JAAOS-D-14-00243

https://www.nysora.com/techniques/upper-extremity/wrist/wrist-block/

Research

REVIEW ARTICLE

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Ishida et al[18]	Modified Wilhelm with preoperative nerve blocks: total or partial denervation	Total: 17 Partial: 12	4.25	Overall, 24% of patients were satisfied with their treatment. Results were better after total denervation than after partial denervation.
Ferreres et al[19]	Wilhelm or PIN neurectomy	Wilhelm: 22 PIN neurectomy: 30	Wilhelm: 5.4 PIN neurectomy: 4.7	Wilhelm: 86% good to excellent. PIN neurectomy: Initial improvement reported at 3- and 6-mo follow-up, with

Research

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Grechenig et al[20]	Wilhelm	22	4.2	77% of patients experienced satisfactory or improved outcomes.
Wilhelm[2]	Wilhelm	374	Variable	81% good to excellent at 1.2-yr follow-up. 77.8% good to excellent at 2.2-yr follow-up. 62.5% good to excellent at 10.5-yr follow-up.
Weinstein and Berger[26]	AIN and PIN neurectomy	19	2.5	85% of patients experienced satisfactory results
Rothe et al[22]	Wilhelm	46	6.3	Of the 32 patients available for follow-up, 62.5% had good to very good results based on the Krimmer score
Schweizer et al[23]	Wilhelm	70	9.6	66% experienced long-term improvement. 50% experienced complete or substantial pain relief.

Research

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Hofmeister et al[27]	AIN and PIN neurectomy	48	2.3	Mean 16% improvement in grip strength ($P = 0.076$). Mean 51% improvement in pain relief (on a scale of 0–100; $P < 0.0001$). Mean DASH score improved by 15 points ($P = 0.0003$).
Strauch[28]	Modified Berger	8	1.5	75% excellent. 1 patient was later diagnosed with rheumatoid arthritis. 1 patient had severe SLAC wrist.
Braga-Silva et al[25]	Wilhelm	49	≥6	80% reported improvement in pain at 1-yr follow-up. Improvement in grip strength was maintained at 6-yr follow-up. ROM improved in all three axes of movement.
Simon et al[29]	Wilhelm	27	6.4	85% of patients experienced complete or nearly complete pain relief.

AIN = anterior interosseous nerve; DASH = Disabilities of the Arm, Shoulder and Hand; PIN = posterior interosseous nerve; ROM = range of motion; SLAC = scapholunate advanced collapse

[a] Reporting on data from Meine J, Buck-Gramcko D: Die Denervation des Handgelenkes: eine gultige Alternative? *Handchirurgie* 1974;6:137-139

[b] Reporting on collected patients of the German Speaking Hand Society

Research

State of the Art in Denervation

- Gardner described elbow innervation in 1947
- Wilheim described a surgical approach in 1996
- Dellon performed an anatomical study in 2009
- Rose et. al Denervation of the Lateral Humeral Epicondyle for Treatment of Chronic Lateral Epicondylitis. J Hand Surg 2013;38A:344–349

Denervation of the Lateral Humeral Epicondyle for Treatment of Chronic Lateral Epicondylitis

Nicholas E. Rose, MD, Scott K. Forman, MD, A. Lee Dellon, MD, PhD

Research

State of the Art in Denervation

Rose et. al Denervation of the Lateral Humeral Epicondyle for Treatment of Chronic Lateral Epicondylitis. J Hand Surg 2013;38A:344–349

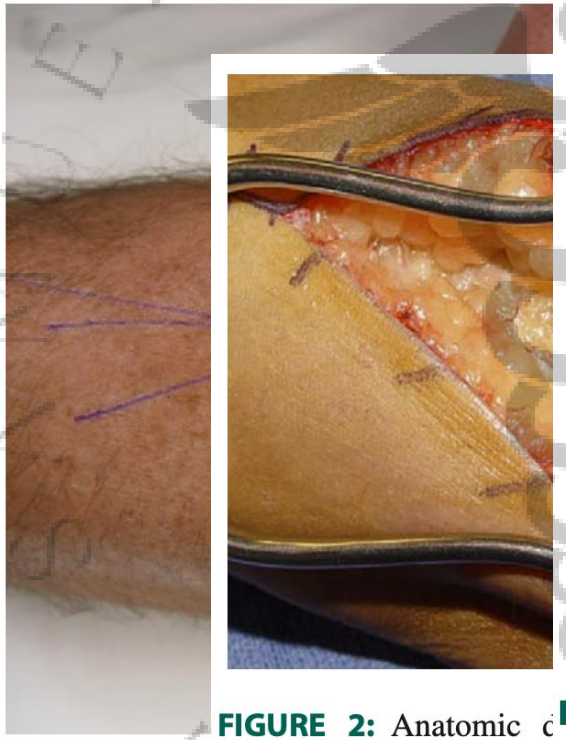


FIGURE 1: S
cutaneous nerv

FIGURE 2: Anatomic c
posterior cutaneous nerv
epicondyle. The actual su
loupe indicates the posteric
of the forearm.

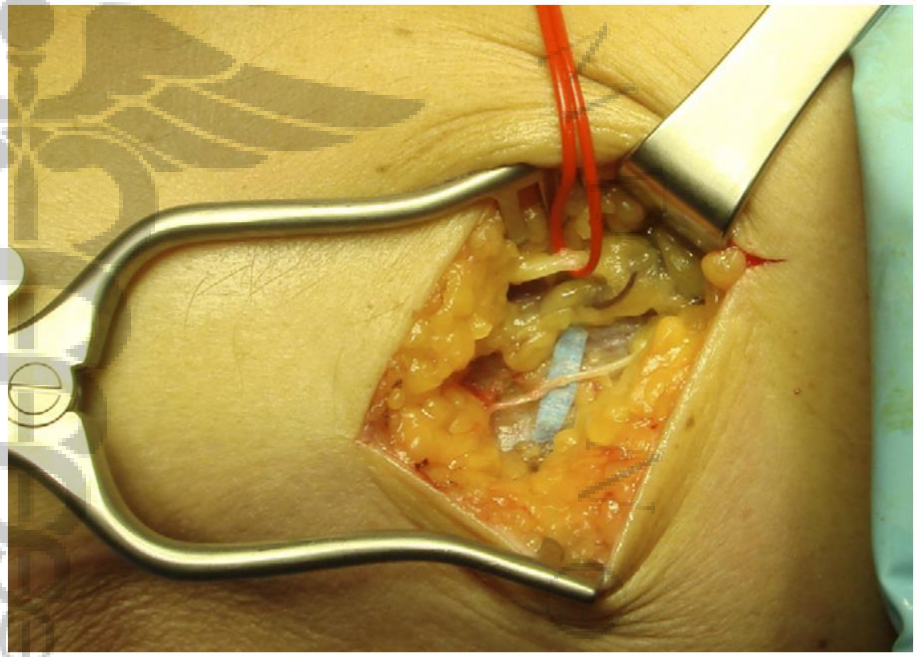


FIGURE 3: A 3- to 4-cm incision is made 2 fingerbreadths proximal to the lateral epicondyle. The red loupe indicates the posterior cutaneous nerve of the forearm. Blue background indicates the posterior branch of the posterior cutaneous nerve of the forearm. Distal is to the left.

utaneous nerve

Research

State of the Art in Denervation

Denervation of the Lateral Humeral Epicondyle for Treatment of Chronic Lateral Epicondylitis

Nicholas E. Rose, MD, Scott K. Forman, MD, A. Lee Dellon, MD, PhD

- 30 patients, 21 females and 9 males
- 28 months of follow up
- Case series (Level 4 evidence)
- Inclusion criteria:
  - 6 months of failed conservative treatment
  - 1 steroid injection
  - 1 diagnostic injection with visual analog scale improvement of 5
- Surgical procedure: transect PBPCNF and transplant into lateral tricep

Research

State of the Art in Denervation

Denervation of the Lateral Humeral Epicondyle for Treatment of Chronic Lateral Epicondylitis

Nicholas E. Rose, MD, Scott K. Forman, MD, A. Lee Dellon, MD, PhD

- Average VAS score improved from a mean of 7.9 (SD, 1.1) preoperatively to a mean of 1.9 (SD 2.8) at the final postoperative measurement (P ≤.001)
- 20 were graded excellent, 4 good, 1 fair, and 5 as failures
  - VAS excellent 0-1, good 2-4 (improved 5 points), fair 5-6 (improved 4 points), failure 5-10 and less than 4 point improvement
- Of the five failures
  - 1 was lost to follow up early
  - 3 of 4 were worker's compensation
  - 4 of 5 identified as having radial tunnel syndrome
    - 4 underwent radial tunnel decompression with 3 of 4 having improvements

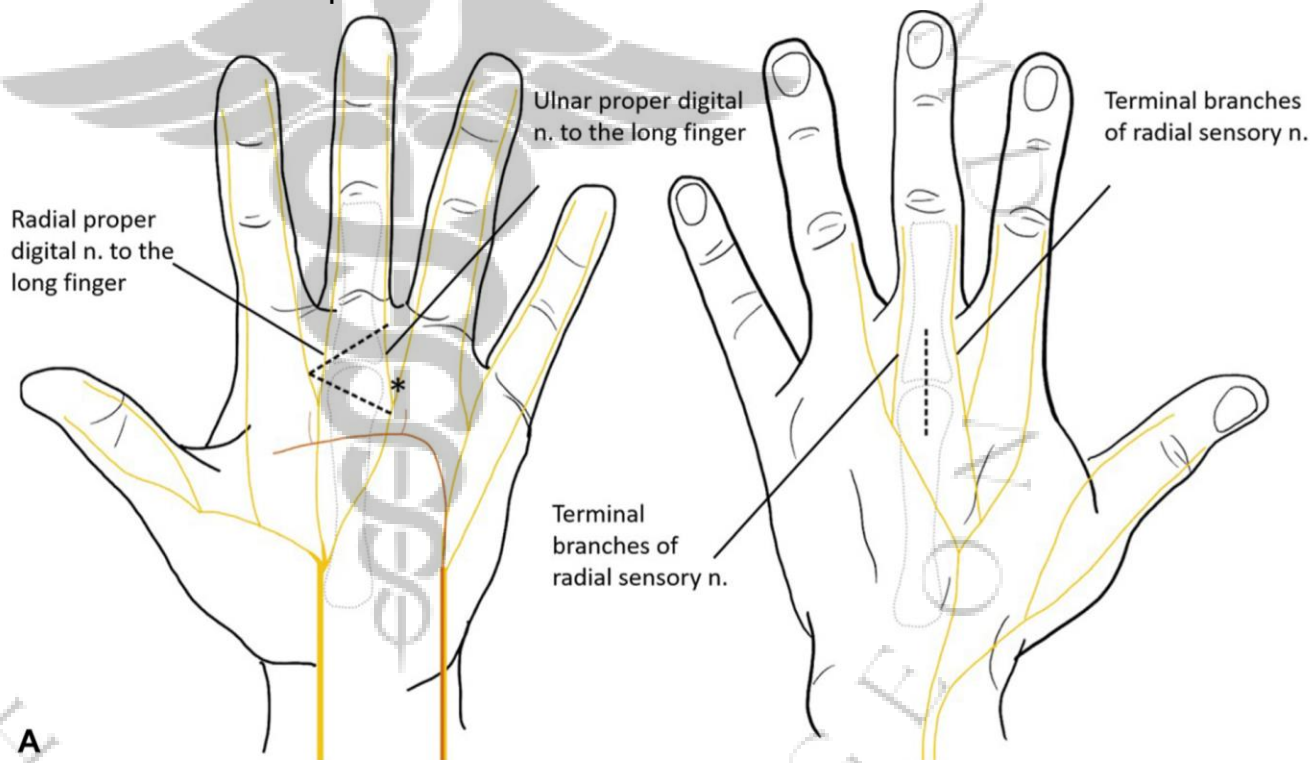
Research

State of the Art in Denervation

Metacarpalphalangeal Joint

Arenas-Prat in 2014 and Madsen in 2018

- minimal follow up



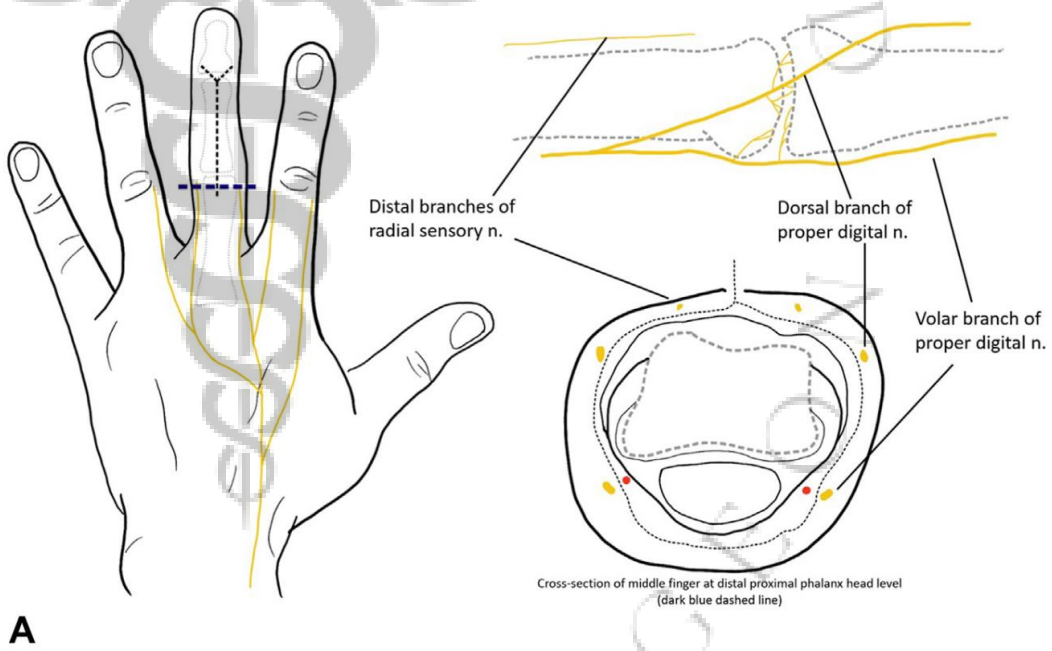
Lifchez et al. Small Joint Denervation of the Hand and Thumb Base: History, Anatomy, Technique, and Outcomes J Hand Surg Am. 2024;49(6):592e601.

Research

State of the Art in Denervation

Proximal Interphalangeal Joint

- Described by Foucher in 1998
  - reported 29 of 34 cases with improvements in pain
- Braga-Silva reported 22 of 24 patients with improved pain from 8 to 2
- Madsen reported all 8 patients with complete resolution of pain at 2 years follow up



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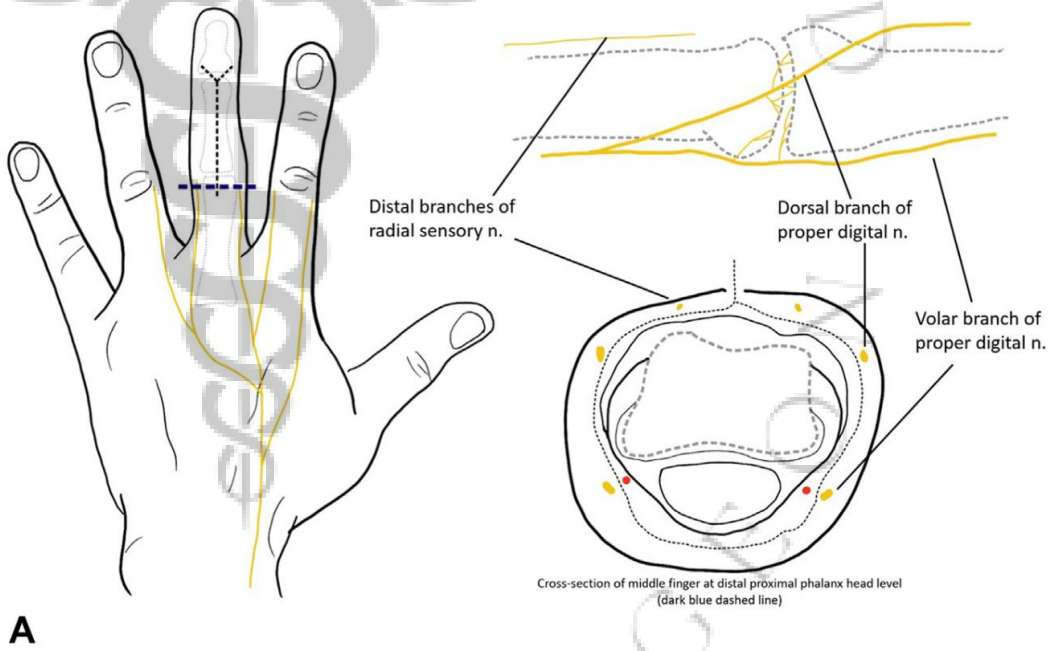
Distal Interphalangeal Joint

Arenas-Prat reported on 10 patients and 7 had ongoing symptom relief at one year

Madsen reported 11 patients with 22 joints at 2 years follow up, 9 of 11 would have the operation again



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Research

State of the Art in Denervation

First carpometacarpal joint

- Prior options for thumb basal joint arthroplasty
  - Silicone spacer
  - Cemented ball and socket joints
  - Metal on polyethylene implants
  - Metal on metal implants

ELSEVIER

Operative Techniques in Orthopaedics

Volume 30, Issue 4, December 2020, 100828

Saddle Hemiarthroplasty for CMC Osteoarthritis

Jorge L. Orbay MD, Sophia Poirier MS

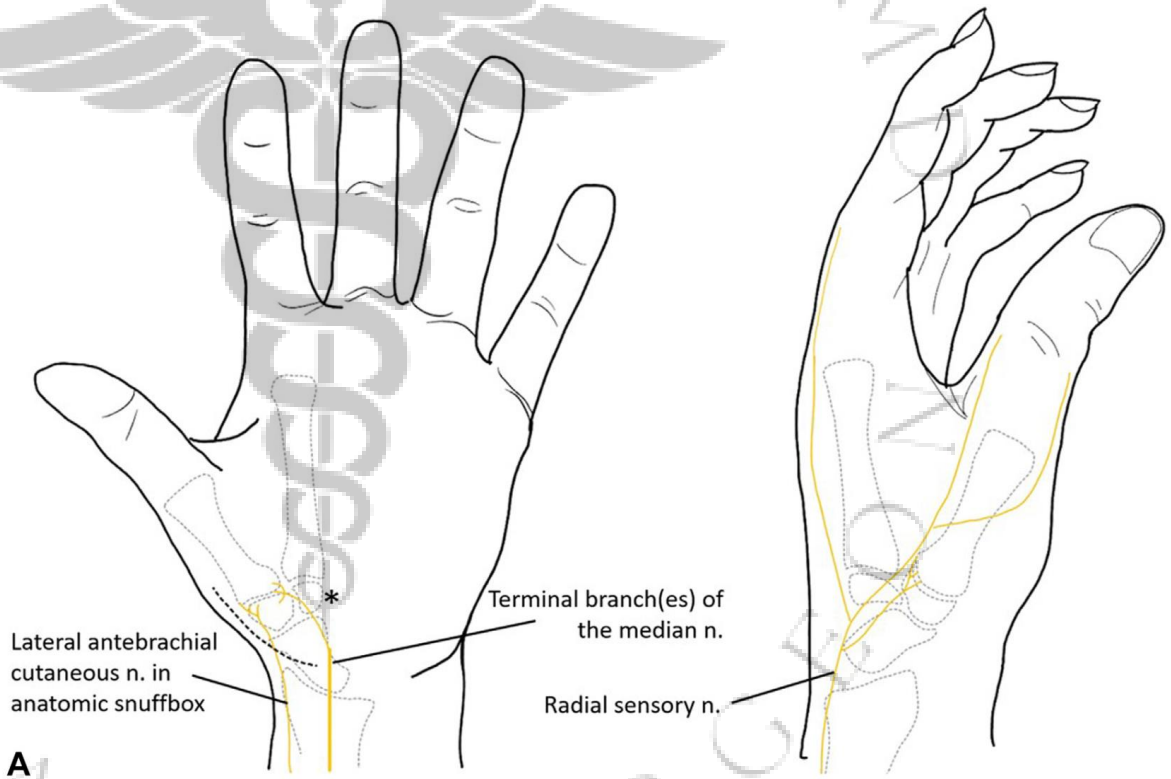
https://skeletaldynamics.com/products/stablyx/

Research

State of the Art in Denervation

Loréa PD. – one of the earliest descriptions for the thumb denervation

First carpometacarpal joint denervation: anatomy and surgical technique. Tech Hand Upper Extrem Surg. 2003;7(1): 26e31.



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Research

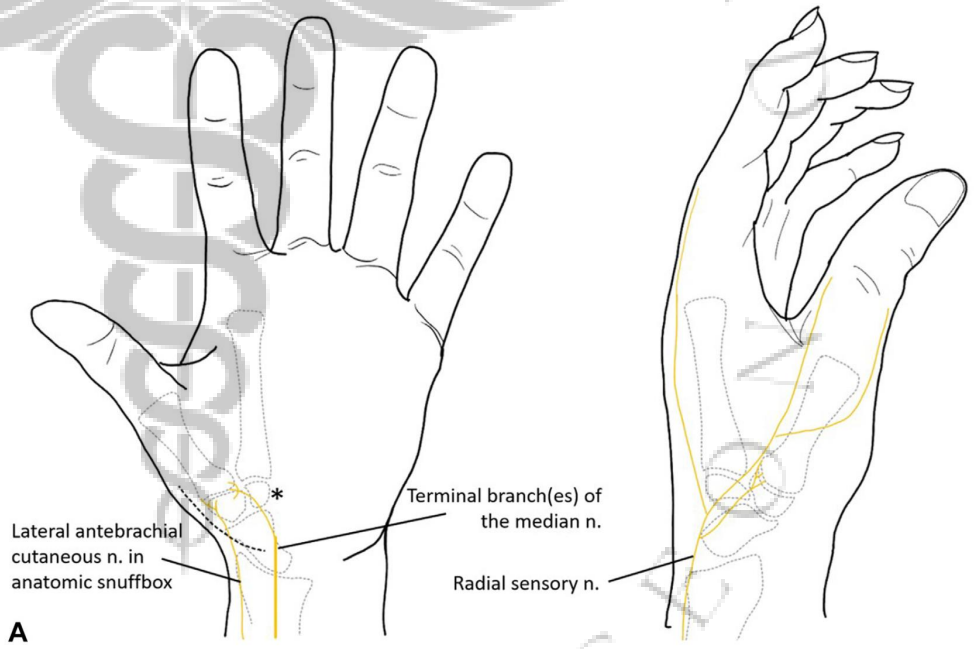
State of the Art in Denervation

Loréa PD.

two incision technique

14 patients with greater than 6 months follow up

12 patients had improvements of 80%



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Research

State of the Art in Denervation

TABLE 2. Outcomes from Previous Reports of Thumb CMC Denervation Surgery*

Author/Year	Number of Patients	Number of Hands	Results
Dellon[11]/2017	3	5	All patients reported pain relief
Donato et al[12]/2018	8	11	Grip strength ↑ 31% over baseline. Pain ↓ 5.4 on Likert pain scale
Giannikas et al[13]/2009	15	15	Key pinch and grip strength ↑ 2-fold over baseline. All patients ↑ Kapandji score. Pain ↓ to 1/3 of baseline
Giesen et al[14]/2017	24	24	Key pinch ↑ 2.4 kg. Grip strength ↑ 3.3 kg. Kapandji score ↑ 0.8. Pain ↓by 3.0 at rest, 2.5 with light activity, 4.0 with heavy activity
Salibi et al[15]/2019	35	35	Kapandji score ↑ 1.92 (out of 10) over baseline
Tuffaha et al[10]/2019	12	12	9/12 patients ↑ grip strength, 10/12 ↑ pinch, 11/12 ↓ pain

*All studies were level IV evidence. The Dellon study did not quantify the amount of pain relief patients experienced.

Lifchez et al. Small Joint Denervation of the Hand and Thumb Base: History, Anatomy, Technique, and Outcomes J Hand Surg Am. 2024;49(6):592e601.

Research

State of the Art in Denervation

TABLE 2. A Summary of First CMC Denervation Study Demographics*

First Author	Year	Patients	Hands	Mean Age (y)	Sex (% F)†	LOE
Tuffaha et al[19]	2019	12	12	59 (46–74)	75	IV
Giannikas et al[20]	2009	15	15	53	100	IV
Salibi et al[21]	2019	35	35	58 (41–72)	82.9	II
Arenas-Prat[22]	2012	16	18			IV
Loréa[16]	2003	14	14	60 (30–77)		IV
Dellon[23]	2016	3	5	64.3 (54–83)	50	IV
Donato et al[24]	2018	8	11	63.4 (7.4) (55–77)‡	62.5	IV
Ehrl et al[25]	2016	42	42	62.7 (9.9)	80.1	IV
Giesen et al[27]	2017	24§	24	62 (39–86)	73.3	IV

LOE, level of evidence.
*37 patients were followed up via in-person examinations, and 23 were followed up via phone.
†"% F" indicates percentage of women.
‡The mean age was reported as mean (SD) (range).
§n = 30 patients, 31 patients' hands were operated upon. 24 patients had follow-up data.

Kevin Rezzadeh, Kristie Rossi, Corrin C. Trerotola, Ajul Shah. First Carpometacarpal Joint Denervation: A Systematic Review. J Hand Surg Am. 2022;47(8):793.e1-e8. 2022

Research

State of the Art in Denervation

TABLE 4. Outcomes of Denervation*

First Author	Key Pinch	Grip Strength	Kapandji Score	Pain
Tuffaha et al[19]	87.5%*	76%*		91.7%*
Giannikas et al[20]	Doubled*	Doubled*	100%†	−65% on average
Salibi et al[21]			+1.92	
Dellon[23]				100%†
Donato et al[24]		Pre 38.4 ft/lb		Pre 7.8
		Post 50.2 ft/lb		Post 2.4
Giesen et al[27]	Pre 3.1 kg	Pre 10.1 kg		
	Post 5.5 kg	Post 13.4 kg	Pre 8.5 Post 9.3	At rest pre 5 post 2.0
				Light tasks pre 7.5 post 5.0
				Hard tasks pre 10 post 6.0

Post, postoperative; pre, preoperative.
*The values represent the percentage of study population that experienced unquantified improvements in a specific category after denervation.
†The values represent improvements in postoperative outcomes relative to preoperative outcomes.

Kevin Rezzadeh, Kristie Rossi, Corrin C. Trerotola, Ajul Shah. First Carpometacarpal Joint Denervation: A Systematic Review. J Hand Surg Am. 2022;47(8):793.e1-e8. 2022

Research

WOUND HEALING/PLASTIC SURGERY · Volume 238, P144-151, June 2019

Download Full Issue

Prospective Clinical Trial Comparing Trapezial Denervation With Trapeziectomy for the Surgical Treatment of Arthritis at the Base of the Thumb

Andrej Salibi, MD, MRCS, MSc [a] · Rachel Hilliam, PhD, BSc (Hons) [b] · Frank D. Burke, MBBS, FRCS [a] · Carlos Heras-Palou, FRCS [a]

- Prospective study from The Pulvertaft Hand Surgery Centre, Royal Derby Hospital, Derby, United Kingdom
  - 35 patients underwent denervation
    - 9 patients converted to trapeziectomy in less than one year
  - 10 patients underwent trapeziectomy

- There was no significant difference in the functional outcomes, time of return to work or cost effectiveness.

Research

EDITOR'S CHOICE

Selective Thumb Carpometacarpal Joint Denervation Versus Trapeziectomy and Ligament Reconstruction With Tendon Interposition for Painful Arthritis: A Prospective Study With 2 Years of Follow-Up

Chris M. Frost, MD,* Visakha Suresh, MD,* William Padovano, MD,* John D. Luck, MD,* Amy Quan, MD,* Pathik Aravind, MBBS,* John V. Ingari, MD,† Dawn M. Laporte, MD,† Jaimie T. Shores, MD,* Scott D. Lifchez, MD*

- Prospective study from Johns Hopkins
  - 33 patients underwent denervation
    - All underwent successful preoperative diagnostic lidocaine test
  - 20 patients underwent LRTI
  - No significant differences were found between denervation and LRTI at any time point for bMHQ, sensation, or grip, key, or 3-point pinch strength

Research

State of the Art in Denervation

Original Research

Selective Thumb Carpometacarpal Joint Denervation for Painful Arthritis: Follow-Up of Long-Term Clinical Outcomes

Visakha Suresh, MD, * Christopher M. Frost, MD, * Scott D. Lifchez, MD *

* *Department of Plastic and Reconstructive Surgery, Johns Hopkins School of Medicine, Baltimore, MD*

Suresh et al.

only long term study of thumb basal joint denervation

at a median of 5 years:

5/9 patients reported: adequate comfort

No further treatment

Research

State of the Art in Denervation

Original Research

Selective Thumb Carpometacarpal Joint Denervation for Painful Arthritis: Follow-Up of Long-Term Clinical Outcomes

Visakha Suresh, MD, * Christopher M. Frost, MD, * Scott D. Lifchez, MD *

* *Department of Plastic and Reconstructive Surgery, Johns Hopkins School of Medicine, Baltimore, MD*

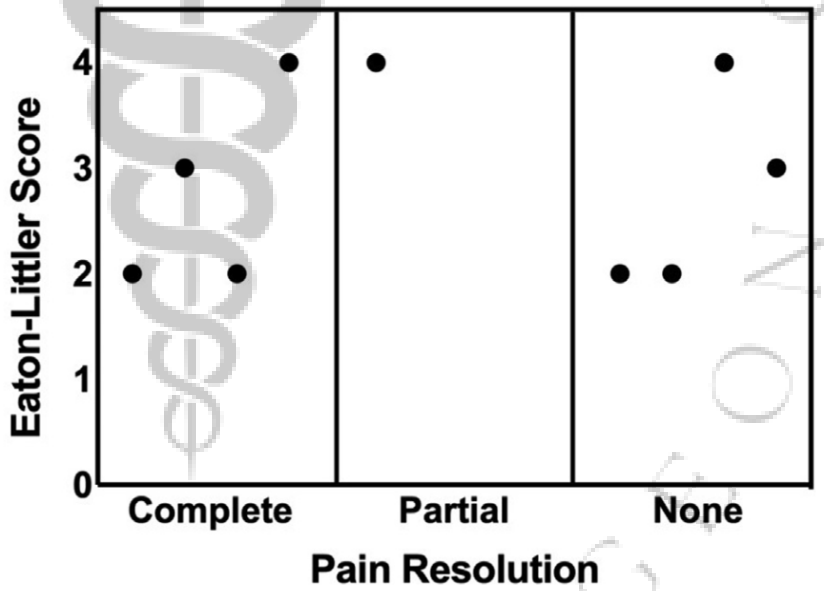


Figure 2. Eaton-Littler Classification and long-term pain resolution after CMC denervation.

The PHWE example

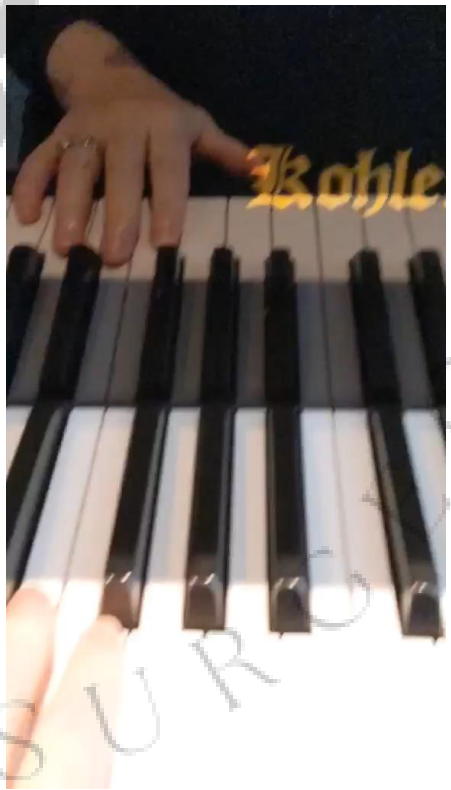
54 RHD F presenting with acute on chronic aggravation of her right thumb pain in 10/2020

-underwent four corticosteroid injections from 2021 to 2023
-underwent right thumb arthroscopy and denervation 3/2023
- follow up visit 1/2025 pain free

The PHWE example

A local nurse was experiencing pain in her left pinky finger that was only worsening with time. Initially, she had pain seldomly with minimal activities but then it progressed to the point where even jostling the hand hurt. She even gave up playing piano to try to alleviate her pain.

"I'm thrilled to say that I'm back to playing piano and folding socks without any trouble. Last week, I visited my grandkids and we held hands without my experiencing any pain at all."



The PHWE protocol

Immediate Post-op 7-10 day:

- Plaster splint
- Minimal weight bearing

Post-op 7-10 visit:

- Remove immobilization
- Referral to hand therapy for mobilization and progressive strengthening

Post-op 4 weeks:

- Return to activity

The PHWE protocol

Conclusions:

Denervation is a reasonable surgical option in the patient that has failed conservative management

-AND-

Desires a shorter rehabilitation at the risk of incomplete pain relief and secondary operation

Probably

- undergoes a successful diagnostic lidocaine injection
- has earlier stage osteoarthritis

PROLIANCE HAND, WRIST & ELBOW PHYSICIANS
WORK AGAIN, PLAY AGAIN!

Thank you!

PROLIANCE HAND, WRIST & ELBOW PHYSICIANS
WORK AGAIN, PLAY AGAIN!

Future Considerations

J Biomed Graph Comput. Author manuscript; available in PMC: 2013 Nov 28.

Published in final edited form as: J Biomed Graph Comput. 2013 Nov;3(4):10.5430/jbgc.v3n4p20. doi: 10.5430/jbgc.v3n4p20

Functional MRI demonstrates pain perception in hand osteoarthritis has features of central pain processing

Nidhi Sofat [1], Cori Smee [1], Monika Hermansson [1], Matthew Howard [2], Emma H Baker [1], Franklyn A Howe [1,2], Thomas R Barrick [1,2]

Author information Copyright and License information

PMCID: PMC3842594 EMSID: EMS55674 PMID: 24294351

Functional MRI analysis showed increased activation in the thalamus, cingulate, frontal and somatosensory cortex in the hand OA group but not in controls (thresholded at $p < 0.05$).

Doctors Demystify

Topic: Cartilage, Ligaments and Fascia
Dates: Time: March 15th, 8am
Location: Overlake PACCAR Education Center

tel 925-330-7510

Doctors Demystify

Are you or someone you know interested in joining our team?

PHWE is hiring for an OT position in our Bellevue location.

Scan QR code to apply!

PROLIANCE HAND, WRIST & ELBOW PHYSICIANS

WORK AGAIN, PLAY AGAIN!