Endoscopic Spine Surgery – A Paradigm Shift in Spine Care

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Disclosures

I believe in utility of the full spectrum of spine surgery

Funding NIH R01, U19, SCIRP DoD, Raisbeck family foundation

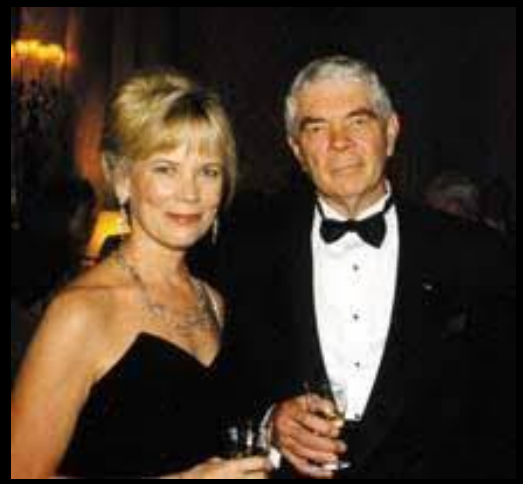
J&J teaching and consulting

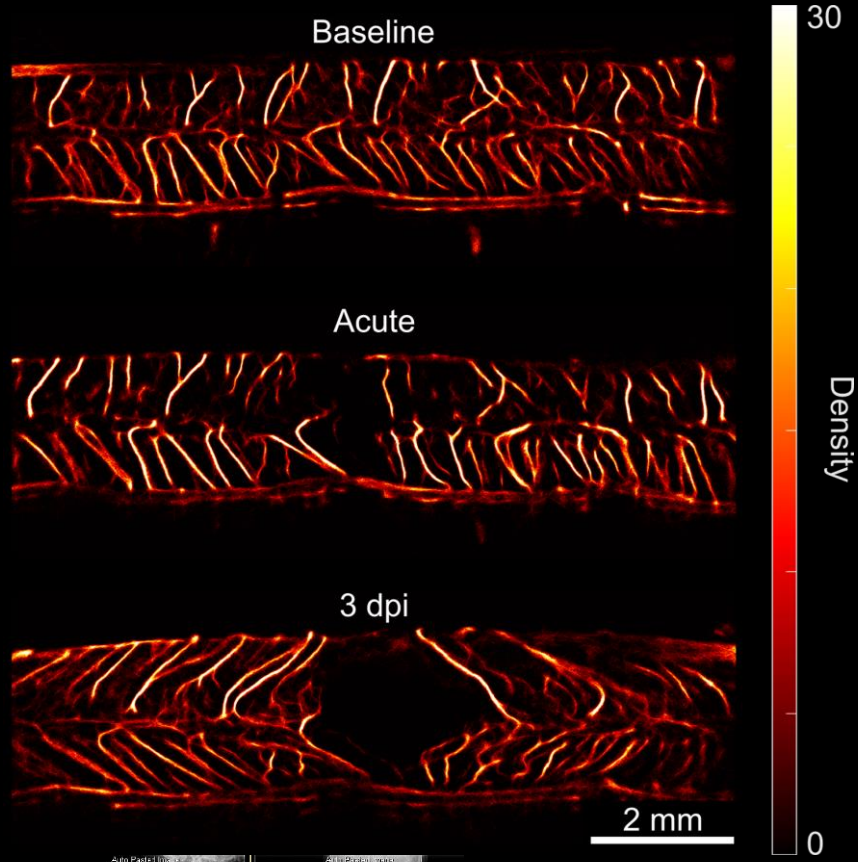
Globus teaching and consulting

Joimax teaching and consulting

AOSpine/Wolf teaching

Innovasis teaching and consulting





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Learning objectives

- Understand the current choke points of endoscopic spine surgery
- Discuss the impact of full-endoscopic spine surgery
- Explore the opportunities with virtual patient care
- Understand the vision moving forward

Endoscopic Spine Surgery – A Paradigm Shift in Spine Care

- *Establish and teach full-endoscopic procedures*
- *Elevate endoscopic spine surgery as standard of care*
- *Make spine care more enjoyable for patients and surgeons*
- *The vision*

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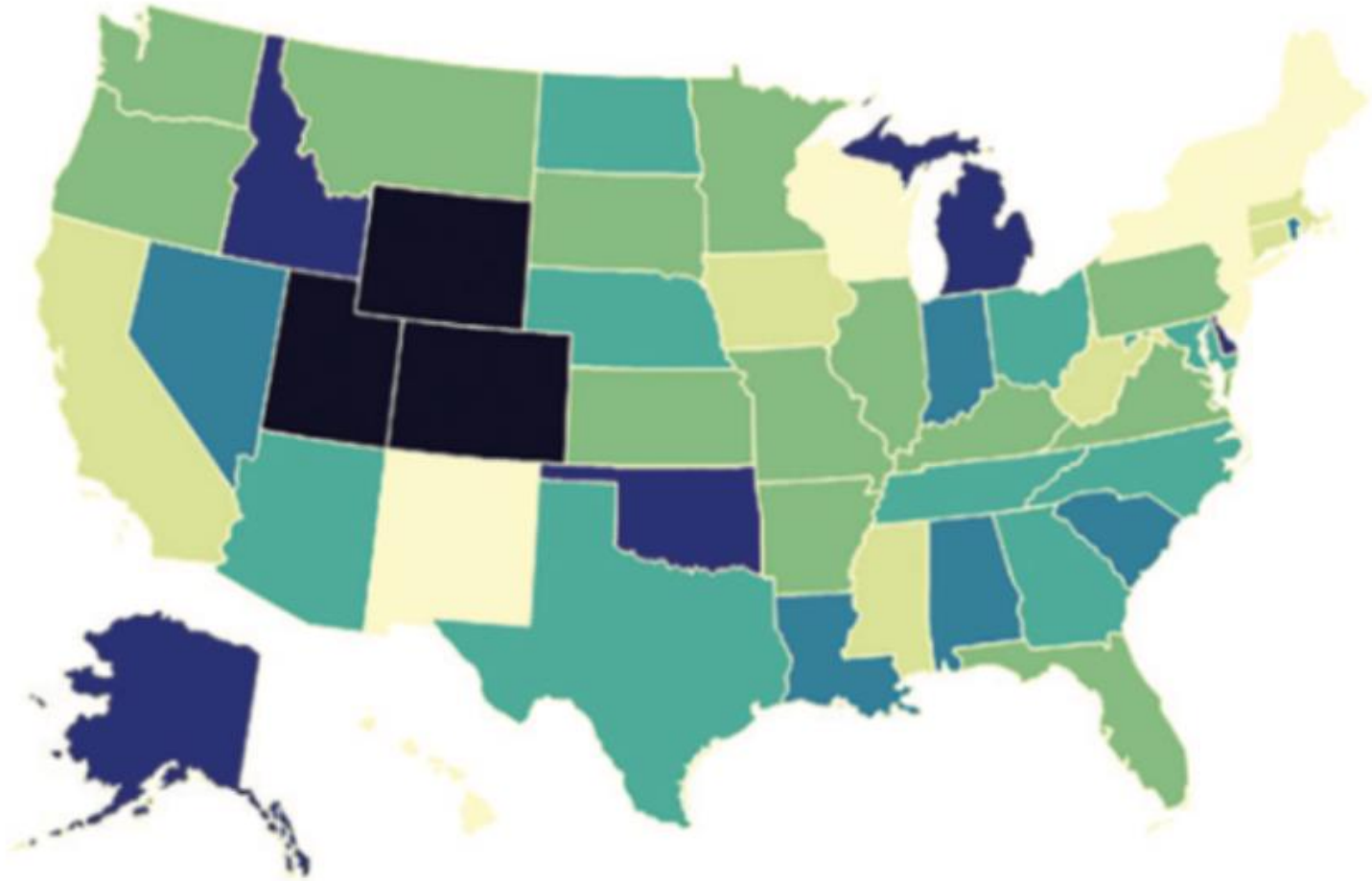
2018 Medicare Inpatient Spinal Fusion Discharges

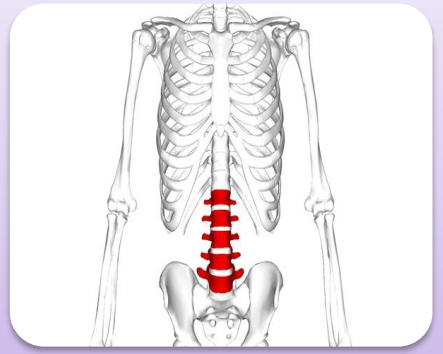


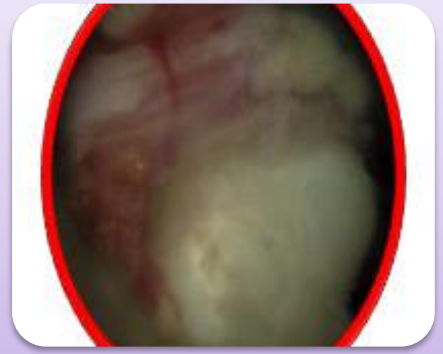
All Medicare Penetration Rate Groups

Low - 2.47	3.693 - 4.02	5.152 - High
2.47 - 3.092	4.02 - 4.428	
3.092 - 3.693	4.428 - 5.152	

Just in case…

Elements for Nomenclature of Endoscopic Spine Surgery



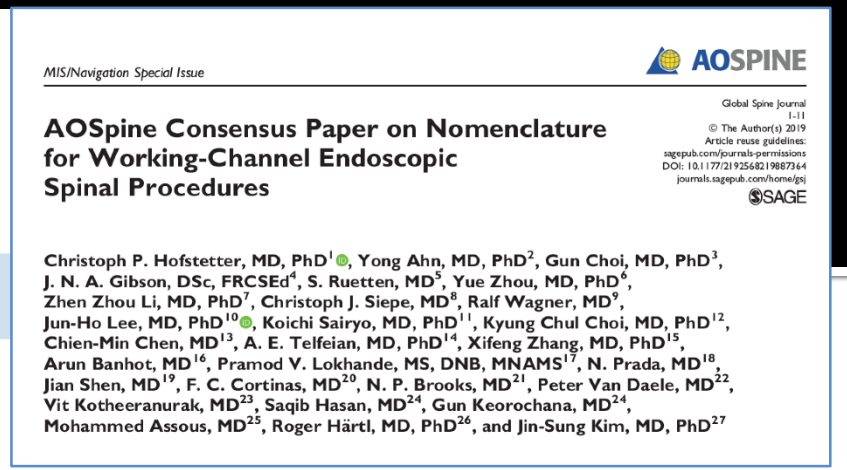


Approach	Instrument	Location	Procedure
anterior	endoscopic	cervical	discectomy
posterior transforaminal		thoracic	foraminotomy
interlaminar		lumbar	LRD
			ULBD

AOSpine Endoscopic Spine Surgery Nomenclature System

Approach corridor/visualization/segment of spine/procedure

1. **Full-endoscopic discectomy**
   a. Full-endoscopic cervical discectomy
      i. Anterior endoscopic cervical discectomy (AECD)
      ii. Posterior endoscopic cervical discectomy (PECD)
   b. Full-endoscopic thoracic discectomy
      i. Transforaminal endoscopic thoracic discectomy (TETD)
   c. Full-endoscopic lumbar discectomy
      i. Transforaminal endoscopic lumbar discectomy (TELD)
      ii. Interlaminar endoscopic lumbar discectomy (IELD)
      iii. Extraforaminal endoscopic lumbar discectomy (EELD)
2. **Full-endoscopic foraminotomy**
   a. Posterior endoscopic cervical foraminotomy (PECF)
   b. Transforaminal endoscopic lumbar foraminotomy (TELF)
   c. Interlaminar contralateral endoscopic lumbar foraminotomy (ICELF)
3. **Full-endoscopic lumbar lateral recess decompression**
   a. Transforaminal endoscopic lateral recess decompression (TE-LRD)
   b. Interlaminar endoscopic lateral recess decompression (IE-LRD)
4. **Full-endoscopic laminotomy for bilateral decompression**
   a. Cervical endoscopic unilateral laminotomy for bilateral decompression (CE-ULBD)
   b. Thoracic endoscopic unilateral laminotomy for bilateral decompression (TE-ULBD)
   c. Lumbar endoscopic unilateral laminotomy for bilateral decompression (LE-ULBD)



MIS/Navigation Special Issue

AOSPINE

Global Spine Journal
1-11

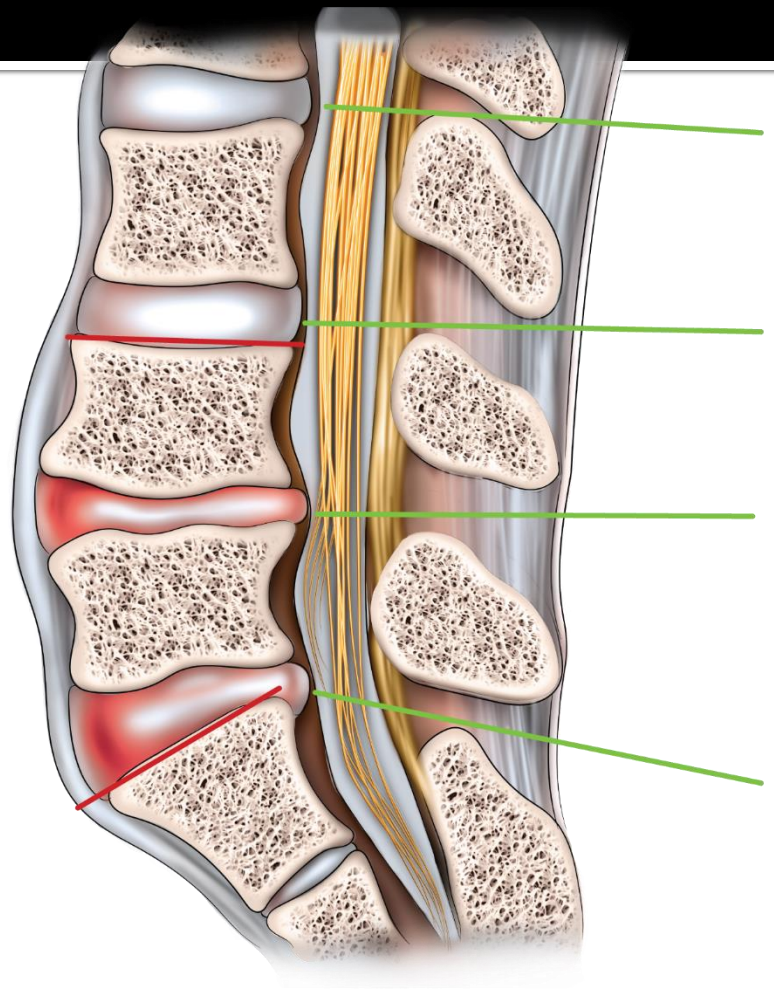
DOI: 10.1177/2192568219887364
journals.sagepub.com/home/gsj
SAGE

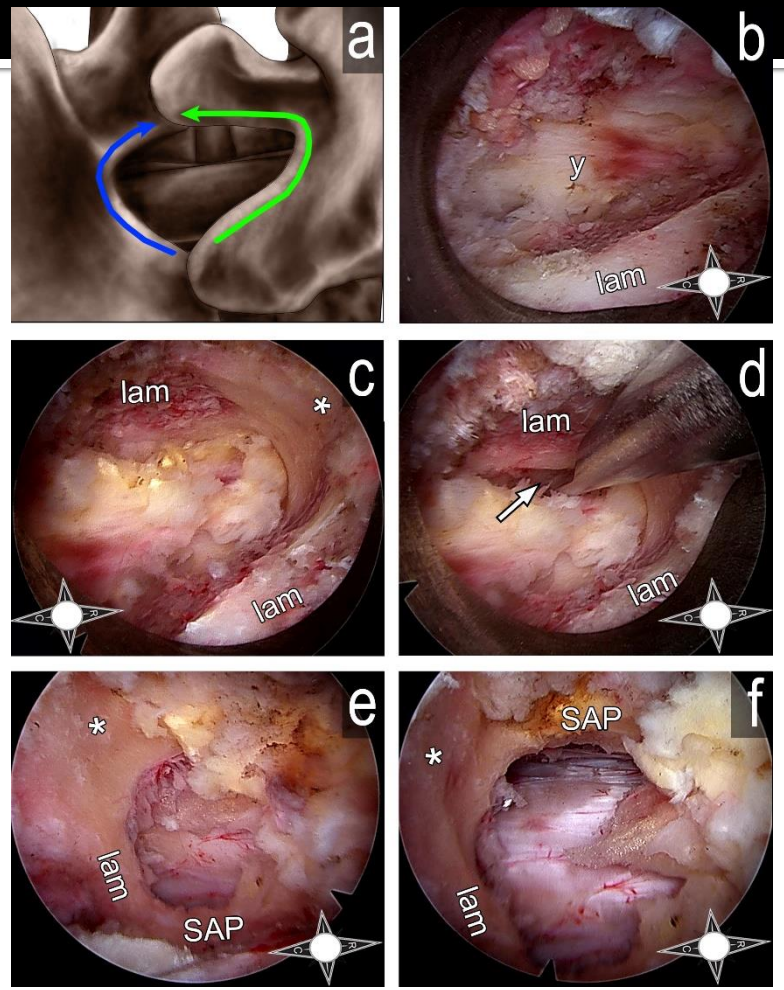
AOSpine Consensus Paper on Nomenclature for Working-Channel Endoscopic Spinal Procedures

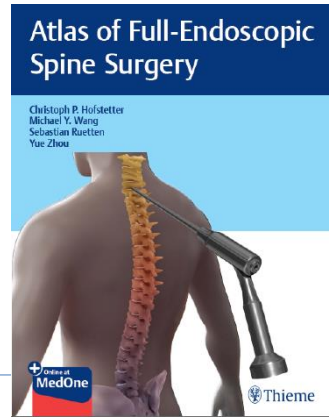
Christoph P. Hofstetter, MD, PhD[1], Yong Ahn, MD, PhD[2], Gun Choi, MD, PhD[3], J. N. A. Gibson, DSc, FRCSEd[4], S. Ruetten, MD[5], Yue Zhou, MD, PhD[6], Zhen Zhou Li, MD, PhD[7], Christoph J. Siepe, MD[8], Ralf Wagner, MD[9], Jun-Ho Lee, MD, PhD[10], Koichi Sairyo, MD, PhD[11], Kyung Chul Choi, MD, PhD[12], Chien-Min Chen, MD[13], A. E. Telfeian, MD, PhD[14], Xifeng Zhang, MD, PhD[15], Arun Banhot, MD[16], Pramod V. Lokhande, MS, DNB, MNAMS[17], N. Prada, MD[18], Jian Shen, MD[19], F. C. Cortinas, MD[20], N. P. Brooks, MD[21], Peter Van Daele, MD[22], Vit Kotheeranurak, MD[23], Saqib Hasan, MD[24], Gun Keorochana, MD[24], Mohammed Assous, MD[25], Roger Härtl, MD, PhD[26], and Jin-Sung Kim, MD, PhD[27]

Approach corridor/ Surgical technique/ segment of spine/ procedure

Lumbar endoscopic unilateral laminotomy for bilateral decompression (LE-ULBD)





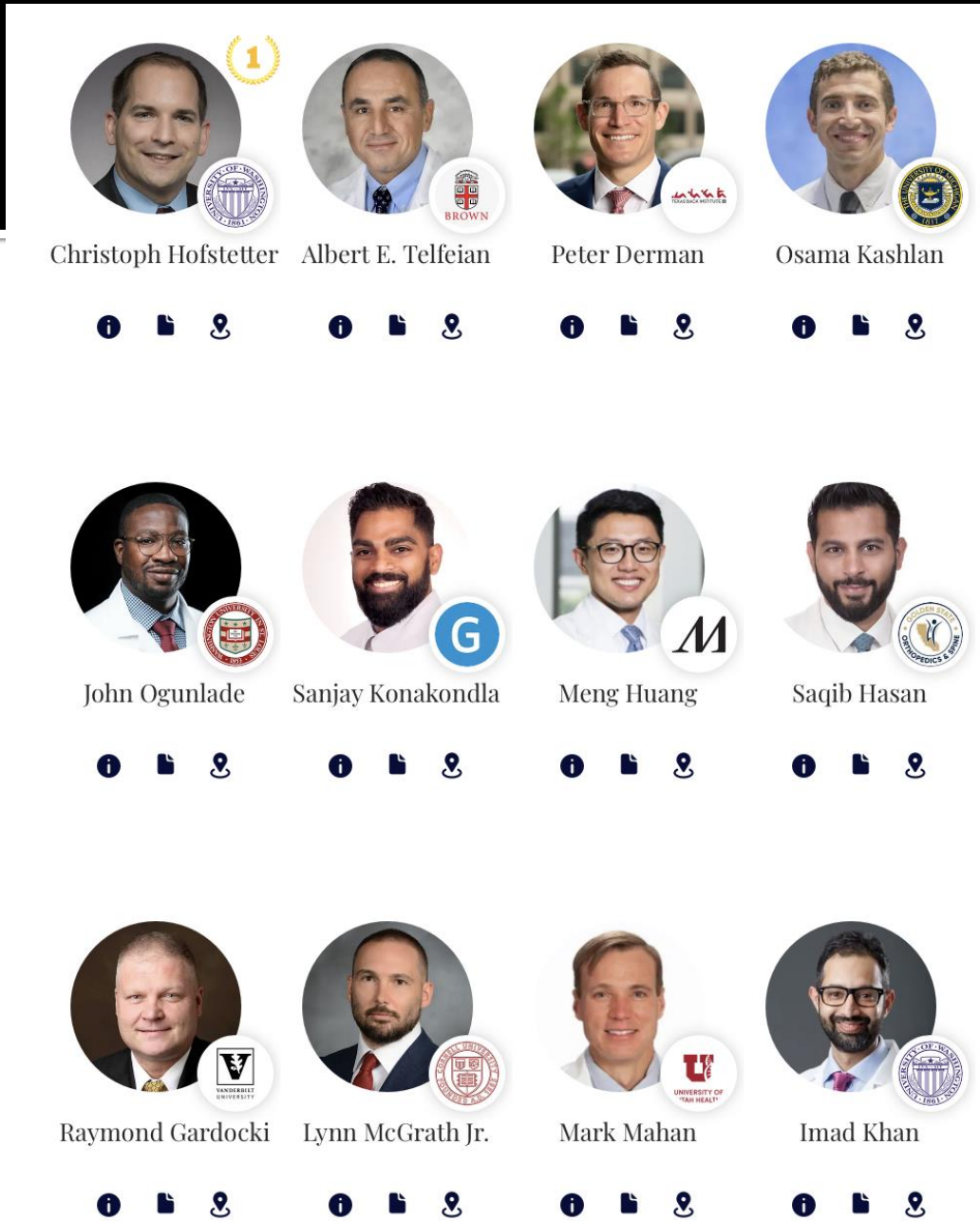


Target area: Inferomedial edge of the lamina

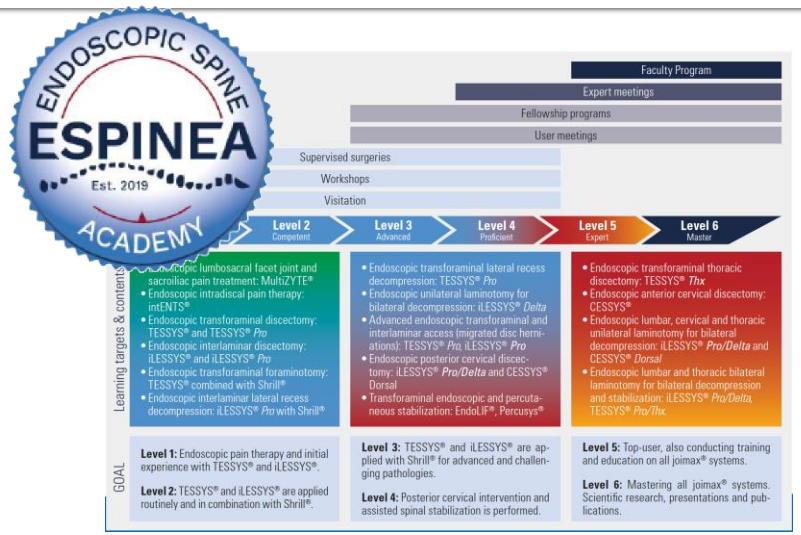
Principal anatomical landmark: Lamina attachment of the yellow ligament

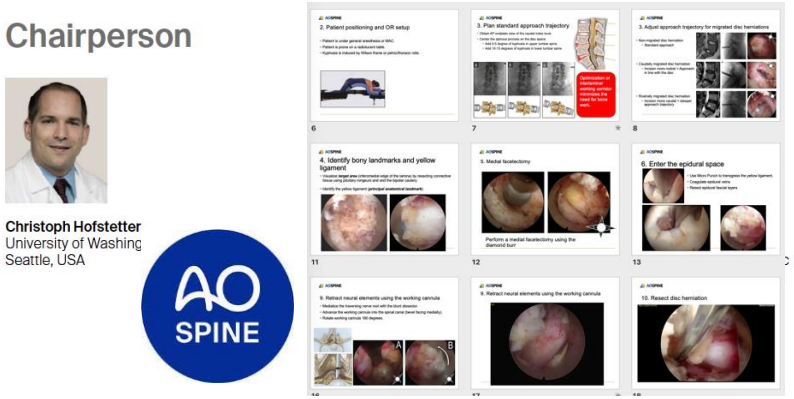
Endoscopic Spine Research Group

- Leading spine surgeons with busy endoscopic spine practices
- Prospective app-based collection of outcomes and complications after full-endoscopic spine surgery
- Define benchmark outcomes following full-endoscopic spine surgery
- Quality improvement efforts of surgical and perioperative care



Societies embracing endoscopic spine surgery





Endoscopic Spine Surgery – A Paradigm Shift in Spine Care

Fast&
Furious Endoscopist

Minimally Invasive
Spine fellowship

- *Establish and teach full-endoscopic procedures*
- *Elevate endoscopic spine surgery as standard of care*
- *Make spine care more enjoyable for patients and surgeons*
- *The vision*

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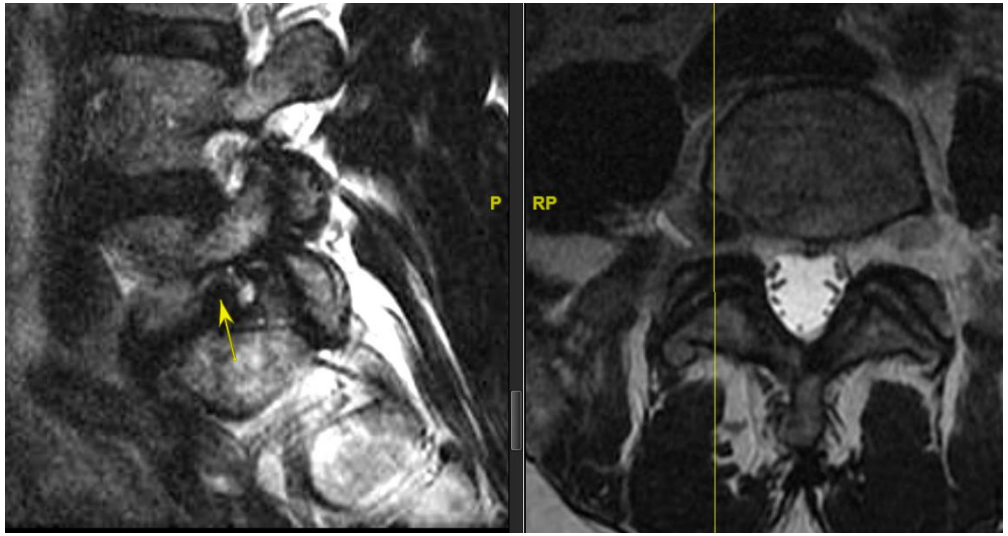
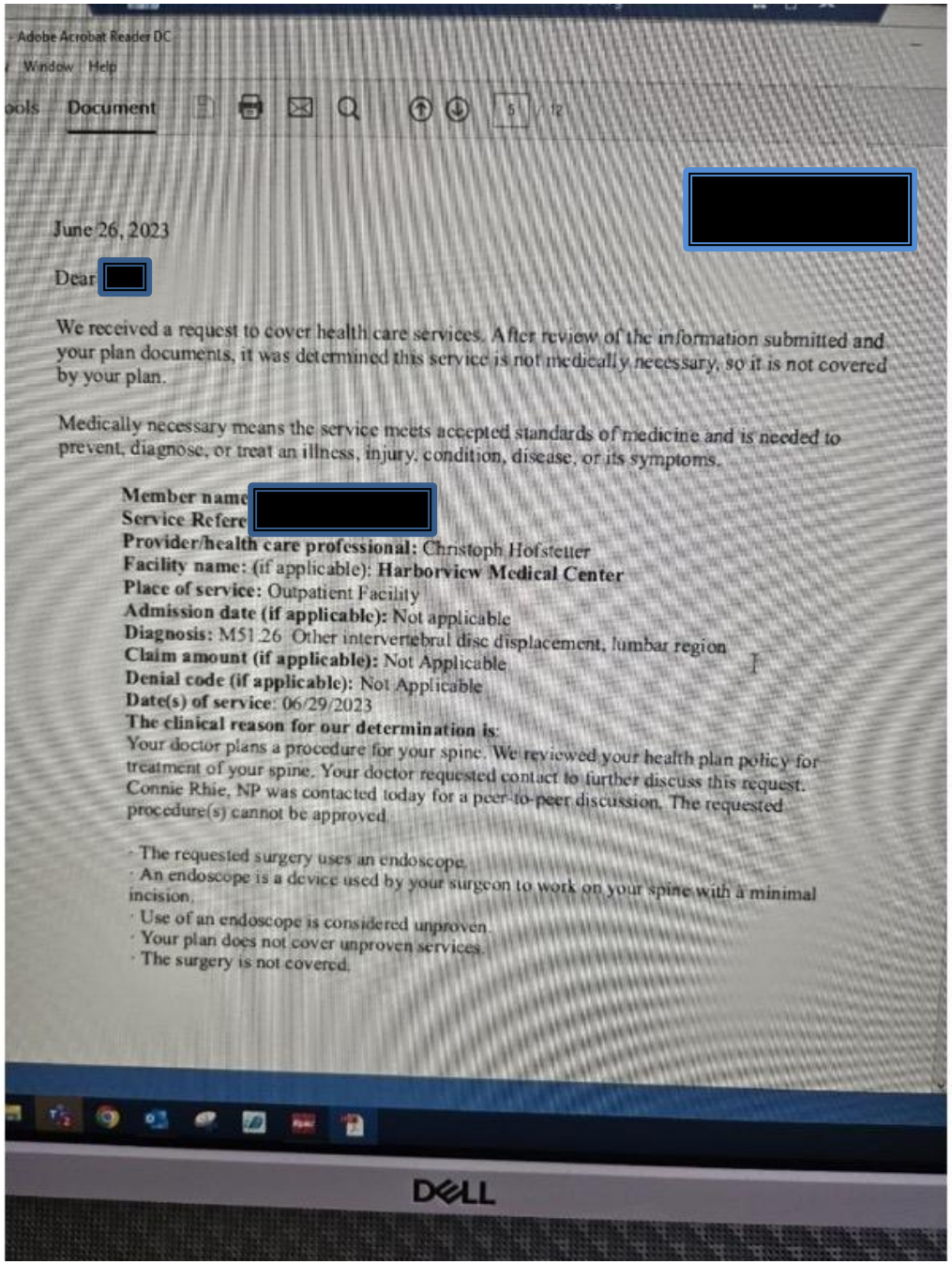
61 yo male with RLE pain and weakness for 3 months

Exam: Gluteus medius 4/5, EHL 4/5

Hofstetter, Christoph Paul, MD (Physician) • Neurosurgery • Encounter Date: 7/3/2023 • Signed

61-year-old male with right lower extremity pain and weakness on examination the patient has right-sided gluteus medius weakness 4+/5, ankle plantarflexion weakness 4/5, EHL weakness 4/5 the patient is larger foraminal L5-S1 disc herniation. Traditional surgery requires resection of the right L5-S1 facet joint in order to gain access to this area. Alternatively the patient may undergo a minimally invasive approach that uses the foramen/superior articular process as surgical corridor. (Hasan at al. 2020). This approach will hopefully avoid the need for a resource intense and expensive single level arthrodesis surgery. This type of approach is impossible to perform without using minimal invasive technique. Using a more aggressive traditional surgery in my opinion causes harm to the patient. Possible complications with foraminal decompression includes postoperative paresthesias. The risk of recurrent disc herniations with foraminal discs is approximately 5 to 10%. Other possible locations include




Adobe Acrobat Reader DC

Window Help

Document

[redacted]

June 26, 2023

Dear [redacted]

We received a request to cover health care services. After review of the information submitted and your plan documents, it was determined this service is not medically necessary, so it is not covered by your plan.

Medically necessary means the service meets accepted standards of medicine and is needed to prevent, diagnose, or treat an illness, injury, condition, disease, or its symptoms.

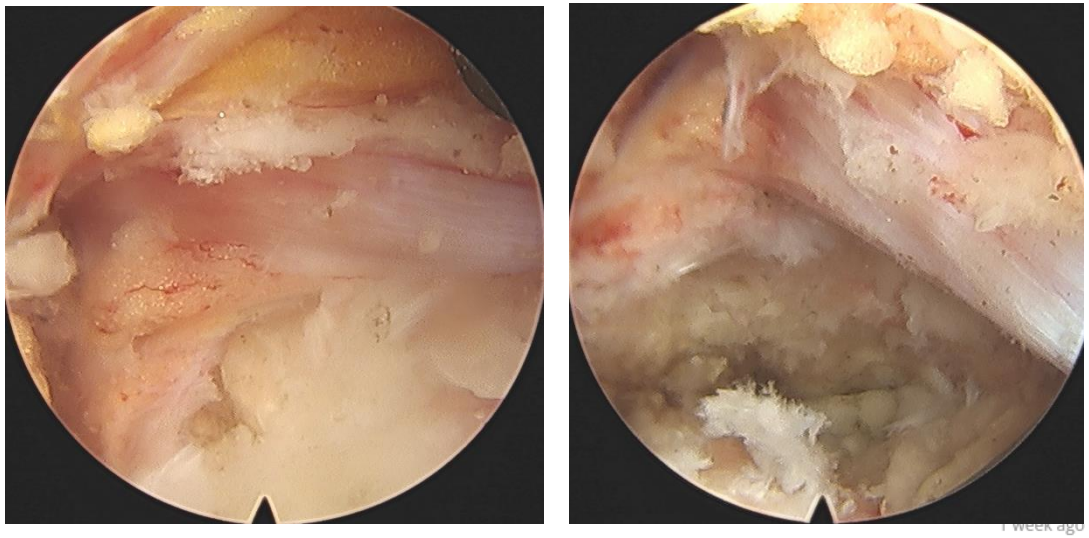
Member name [redacted]
Service Refere
Provider/health care professional: Christoph Hofstetter
Facility name: (if applicable): **Harborview Medical Center**
Place of service: Outpatient Facility
Admission date (if applicable): Not applicable
Diagnosis: M51.26 Other intervertebral disc displacement, lumbar region
Claim amount (if applicable): Not Applicable
Denial code (if applicable): Not Applicable
Date(s) of service: 06/29/2023
The clinical reason for our determination is:
Your doctor plans a procedure for your spine. We reviewed your health plan policy for treatment of your spine. Your doctor requested contact to further discuss this request. Connie Rhie, NP was contacted today for a peer-to-peer discussion. The requested procedure(s) cannot be approved.

- The requested surgery uses an endoscope.
- An endoscope is a device used by your surgeon to work on your spine with a minimal incision.
- Use of an endoscope is considered unproven.
- Your plan does not cover unproven services.
- The surgery is not covered.

DELL

61 yo male with RLE pain and weakness for 3 months

Procedure: L5/S1 TELD using trans SAP technique



1 week ago

Hi Dr. Hofstetter, sorry I didn't see this chat.
Ten days and I am doing well. Having no pain while standing or walking is amazing.

14 hours ago

Lower back is sore along with my legs that are not use to squats!

14 hours ago

Me

Thank you so much for the update. Let's take it easy and keep our fingers crossed

14 hours ago

ODI

VAS

VAS Back

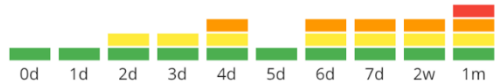
VAS Left Leg

VAS Right Leg

DOI

HEALTH DATA

Steps



Randomized trials demonstrates non-inferiority of FESS

Eur Spine J (2017) 26:847–856
DOI 10.1007/s00586-016-4885-6

ORIGINAL ARTICLE

A randomised controlled trial of transforaminal endoscopic discectomy vs microdiscectomy

J. N. Alaistair Gibson[1] · Ashok S. Subramanian[1] · Chloe E. H. Scott[1]

SPINE Volume 33, Number 9, pp 931–939

Full-Endoscopic Interlaminar and Transforaminal Lumbar Discectomy *Versus* Conventional Microsurgical Technique

A Prospective, Randomized, Controlled Study

Sebastian Ruetten, MD, PhD.* Martin Komp, MD, PhD.* Harry Merk, MD.†

Pain Physician 2015; 18:61-70 • ISSN 1533-3159

Randomized Trial

Bilateral Spinal Decompression of Lumbar Central Stenosis with the Full-Endoscopic Interlaminar Versus Microsurgical Laminotomy Technique: A Prospective, Randomized, Controlled Study

SPINE Volume 33, Number 9, pp 940–948

Full-Endoscopic Cervical Posterior Foraminotomy for the Operation of Lateral Disc Herniations Using 5.9-mm Endoscopes

A Prospective, Randomized, Controlled Study

Sebastian Ruetten, MD, PhD,* Martin Komp, MD, PhD,* Harry Merk, MD,†
and Georgios Godolias, MD‡

Full endoscopic versus open discectomy for sciatica: randomised controlled non-inferiority trial

Pravesh S Gadjradj,[1,2] Sidney M Rubinstein,[3] Wilco C Peul,[4] Paul R Depauw,[5]
Carmen L Vleggeert-Lankamp,[4] Ankie Seiger,[3] Job LC van Susante,[6] Michiel R de Boer,[3,7]
Maurits W van Tulder,[3] Biswadjiet S Harhangi[1]

FESS is safe and efficient alternative when compared to MIS in the cervical, thoracic and lumbar spine

5 RCTs show rapid recovery with fewer complications following FESS

FESS is advantageous regarding operation, self reported pain, quality of life complication, traumatization, rehabilitation

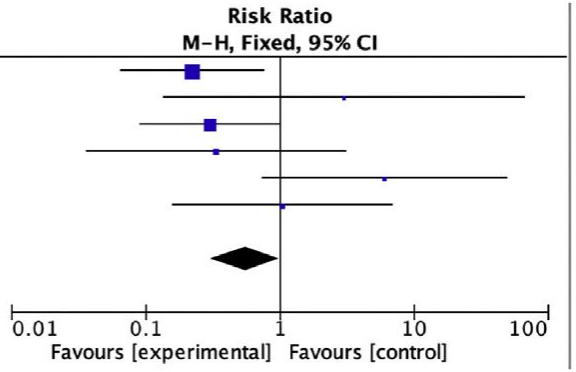
Complications of Full-Endoscopic Lumbar Discectomy versus Open Lumbar Microdiscectomy: A Systematic Review and Meta-Analysis

Chao-Chun Yang[1], Chien-Min Chen[2,5,6], Martin Hsiu-Chu Lin[1], Wei-Chao Huang[1], Ming-Hsueh Lee[1], Jin-Sung Kim[3], Kuo-Tai Chen[1,4]

6 RCT with a total of
591 patients were included

Study or Subgroup	FELD Events	FELD Total	OLM Events	OLM Total	Weight	Risk Ratio M-H, Fixed, 95% CI	Year
Ruetten, 2008	3	91	13	87	43.4%	0.22 [0.07, 0.75]	2008
Pan, 2014	1	10	0	10	1.6%	3.00 [0.14, 65.90]	2014
Pan, 2016	3	48	12	58	35.5%	0.30 [0.09, 1.01]	2016
Ding, 2017	1	50	3	50	9.8%	0.33 [0.04, 3.10]	2017
Gibson, 2017	6	70	1	70	3.3%	6.00 [0.74, 48.55]	2018
Meyer, 2020	2	23	2	24	6.4%	1.04 [0.16, 6.80]	2020
Total (95% CI)		**292**		**299**	**100.0%**	**0.55 [0.31, 0.98]**	
Total events	16		31				

Heterogeneity: $\chi^2 = 9.91$, df = 5 (P = 0.08); $I^2 = 50\%$
Test for overall effect: Z = 2.04 (P = 0.04)



Endoscopic spine surgery reduces the rate of overall complications by approximately 50%

Full-endoscopic surgery has higher rate of :

13 cohort studies:

- higher risk of transient dysesthesia (RR [3.70, 95% CI [1.54e8.89)
- Residual fragment (RR [5.29, 95% CI [2.67e10.45)
- Revision surgeries (RR[1.53, 95% CI[1.12e2.08)

Prospective multicenter study on infection with full-endoscopic spine surgery

Tobias Prasse, MD

1261 full-endoscopic spine surgeries compared with 5936 propensity-matched patient cohort from the NSQIP database (age, BMI, gender, co-morbidities)

	Propensity-Matched		
	Open	Endoscopic	p-value
N (%)	5936 (82.5)	1261 (17.5)	
Operative Level			<0.001
Cervical	466 (7.9)	90 (7.1)	
Thoracic	25 (0.4)	19 (1.5)	
Lumbar	5445 (91.7)	1152 (91.4)	
Number of operative segments			0.088
1	4811 (81.0)	1049 (83.2)	
2	1009 (17.0)	199 (15.8)	
3	103 (1.7)	12 (1.0)	
4	13 (0.2)	1 (0.1)	
Inpatient	1624 (27.4)	332 (26.3)	0.455
Total operative time (minutes)	99 ± 48	99 ± 77	0.746

University of Washington (Dr. Hofstetter)

Brown University (Dr. Telfeian)

University of Utah (Dr. Mahan)

Ligamenta (Dr. Wagner)

Multicenter trial on infection with full-endoscopic spine surgery

1261 full-endoscopic spine surgeries compared with 5936 propensity-matched patient cohort from the NSQIP database (age, BMI, gender, co-morbidities)

<u>Results:</u>
Full-endoscopic: 1 surgical site infection (0.001%)
Traditional: 67 surgical site infection (1.1 %)
(P< 0.001)

<u>Conclusion:</u>
Full-endoscopic spine surgery has a ***16 times reduced risk*** of surgical site infection compared to traditional surgery

University of Washington (Dr. Hofstetter)

Brown University (Dr. Telfeian)

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Electronic medical record-related burnout in healthcare providers: a scoping review of outcomes and interventions

Calandra Li ,[1] Camilla Parpia ,[1] Abi Sriharan ,[2,3] Daniel T Keefe [4,5]

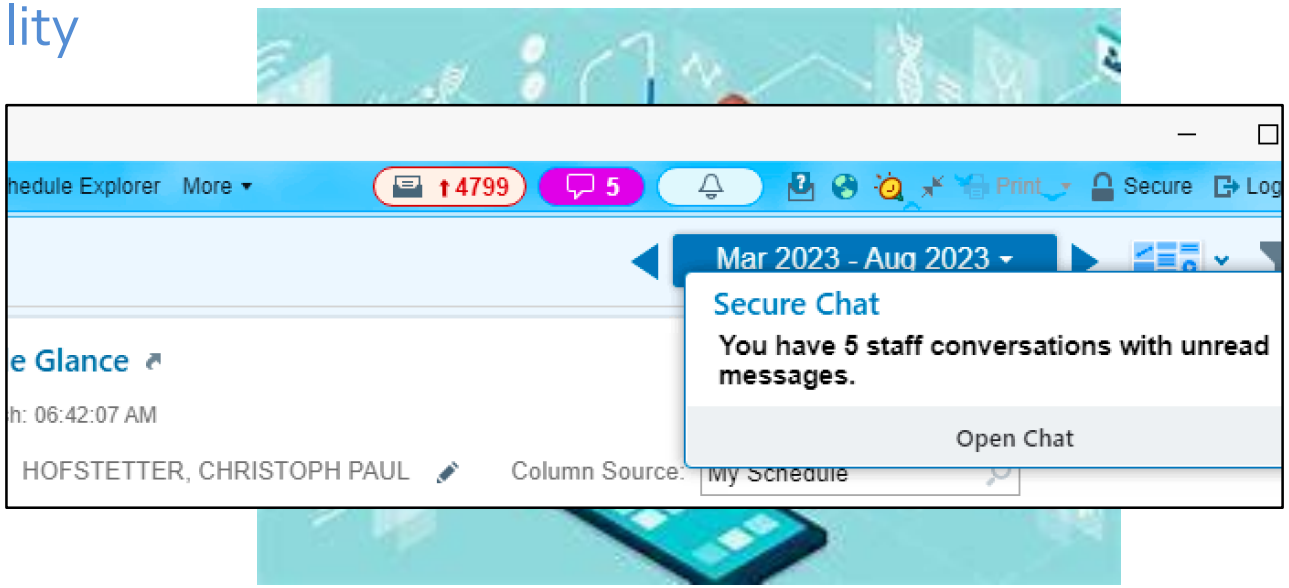
BMJ Open

Scoping review of 25 studies supporting EMR contribution to provider burnout

Main factors:

- Poor provider EMR functionality and usability
- Extensive time spent for documentation
- # of in basket messages

- Currently no strategies to remedy the issue



Hospital-based EMR:

- Billing and revenue cycle management
- Inventory Management
- Logistics and Resource Management
- Reporting and Analytics
- Patient information management

Physician-driven patient care companion

- Relevant outcome and biomarker tracking
- Asynchronous communication
- Define benchmark outcomes
- Quality improvement initiatives

App-based patient follow up– The Benefits

Patients:

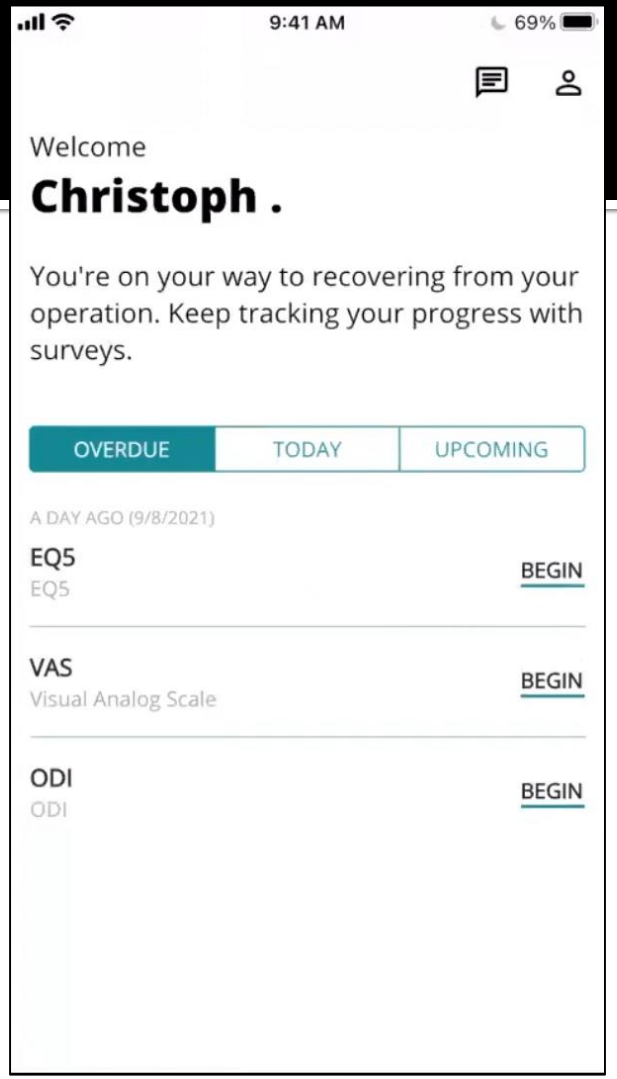
- Tracking your recovery
- Easy access to the surgeon
- Electronic follow-up to avoid trips to the hospital
- Resources for recovery

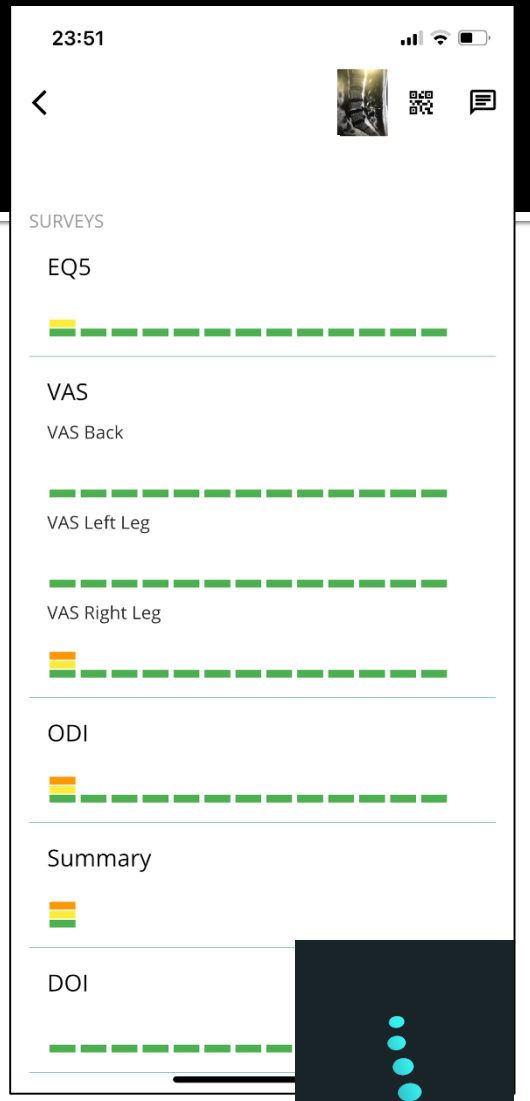
Challenges:

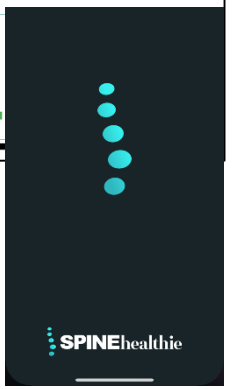
- Efficient sign up
- Simple user interface

New clinic workflow

- Patients are signed up for the SPINEHealthie app during the preoperative visit
- Patients PROMs th first 7 days, 1 mo, 3 mo, 6 mo, 12 mo, 24 mo
- Virtual postoperative follow-up at 2 weeks and 3 months

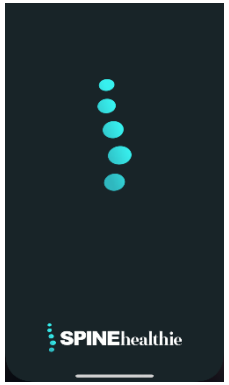


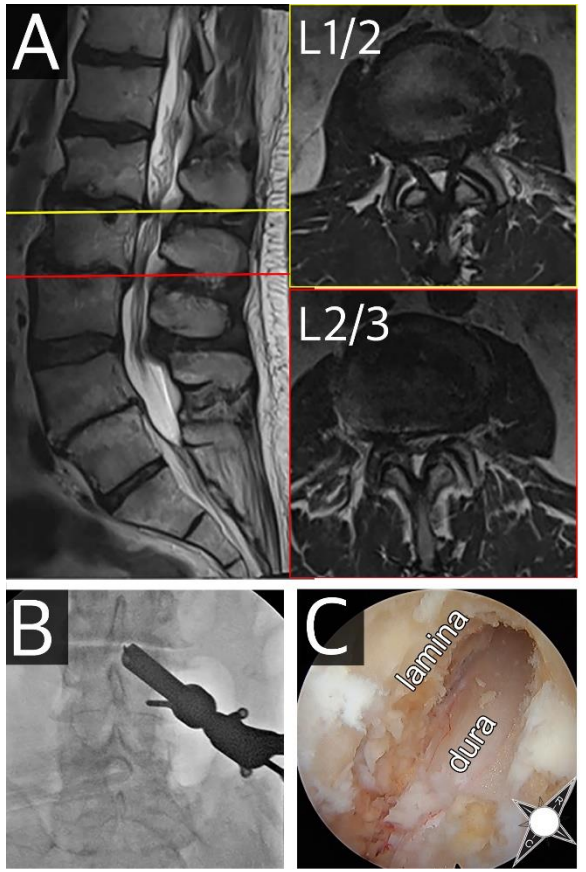


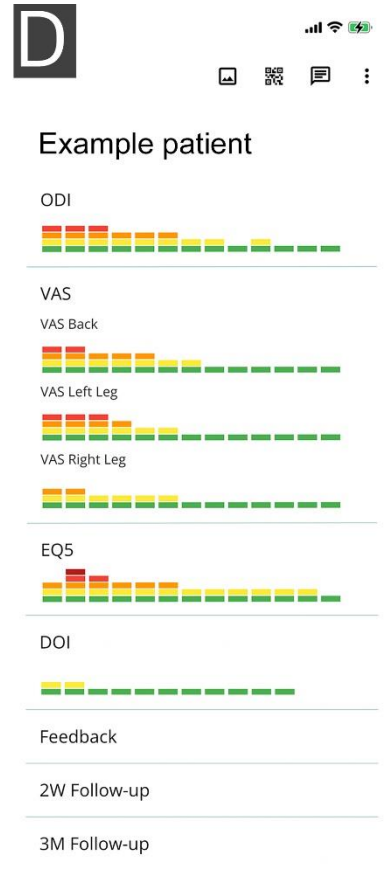


SPINEHealthie smartphone app

- Real-time PROMs collection
- Physiological monitoring (steps)
- Chat
- Review of images
- Virtual follow-up





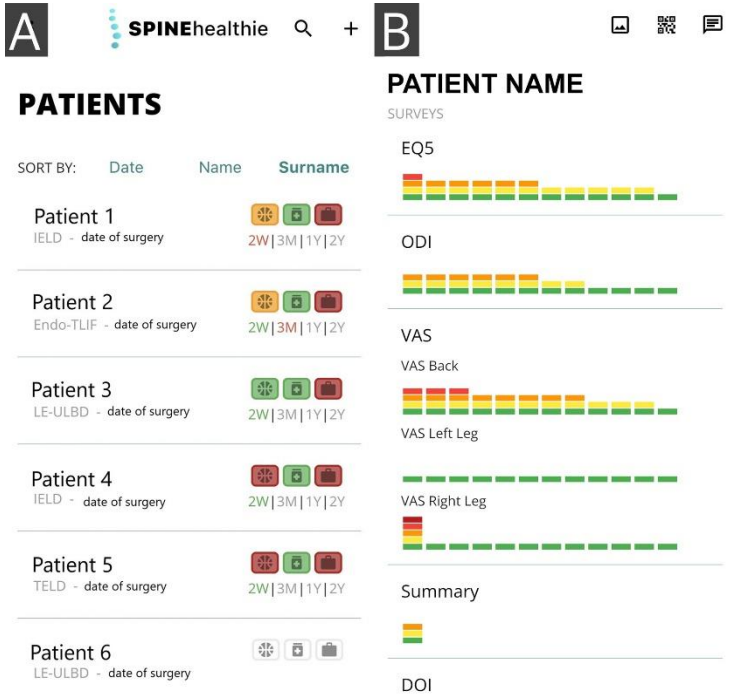


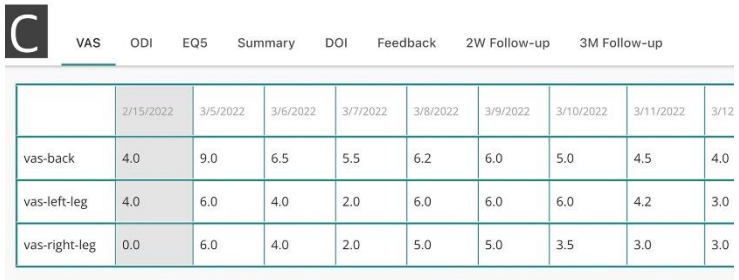
Remote patient monitoring following full endoscopic spine surgery: feasibility and patient satisfaction

Tobias Prasse, MD,[1,4] Natalie Yap, BS,[1] Sananthan Sivakanthan, MD,[1] James Pan, MD,[1] John Ogunlade, DO,[2] Jan Bredow, MD,[3] Peer Eysel, MD,[4] Richard G. Ellenbogen, MD,[1] and Christoph P. Hofstetter, MD, PhD[1]

JNS SPINE

- 91% (n = 71) of patients elected virtual postoperative care for the first 3 months after surgery
- 85% of patients provided at least one PROM
- Three-month follow-up PROMs were available for 74.6%
- 100% of Patients were compliant with virtual postoperative follow-up

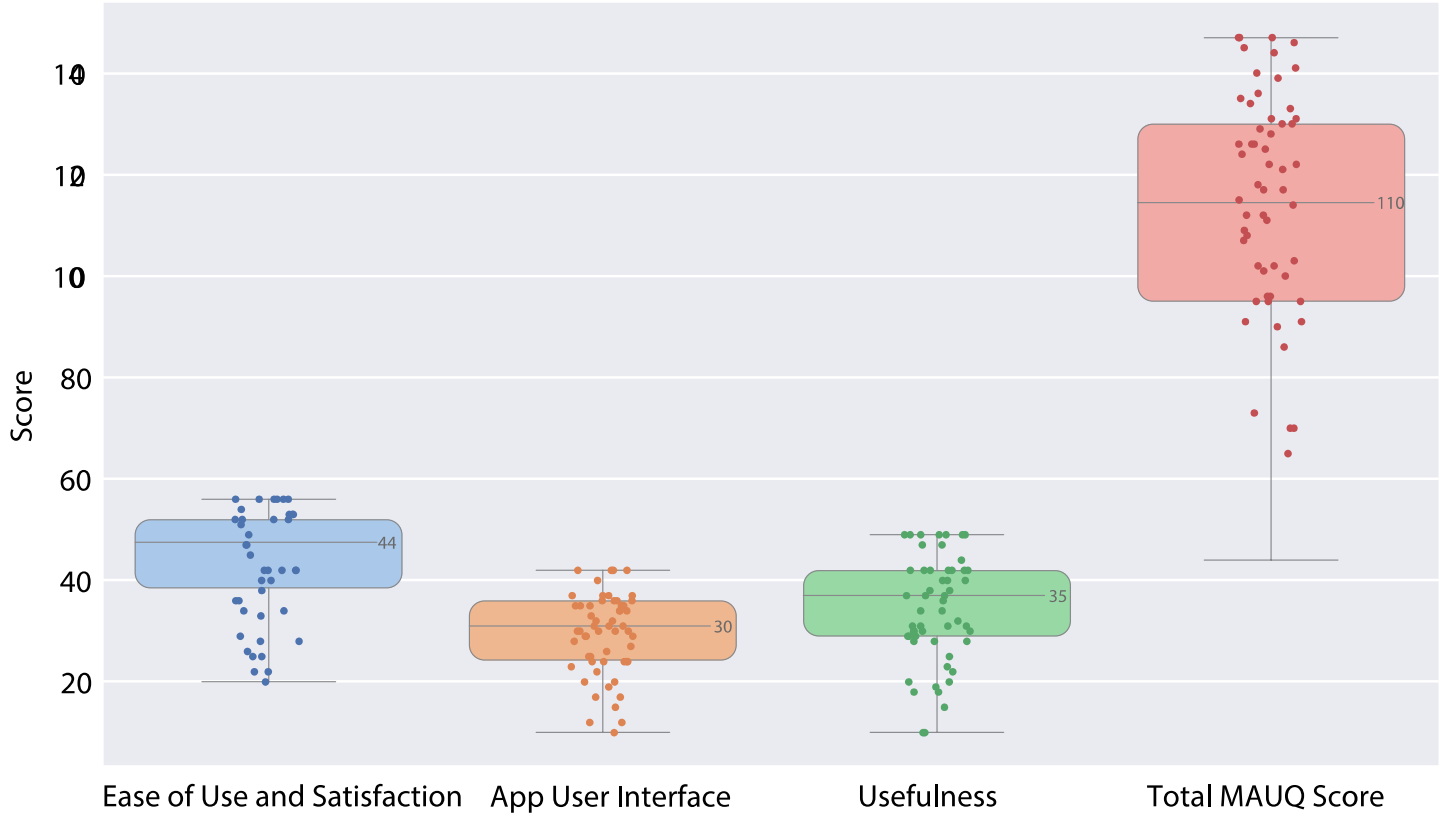




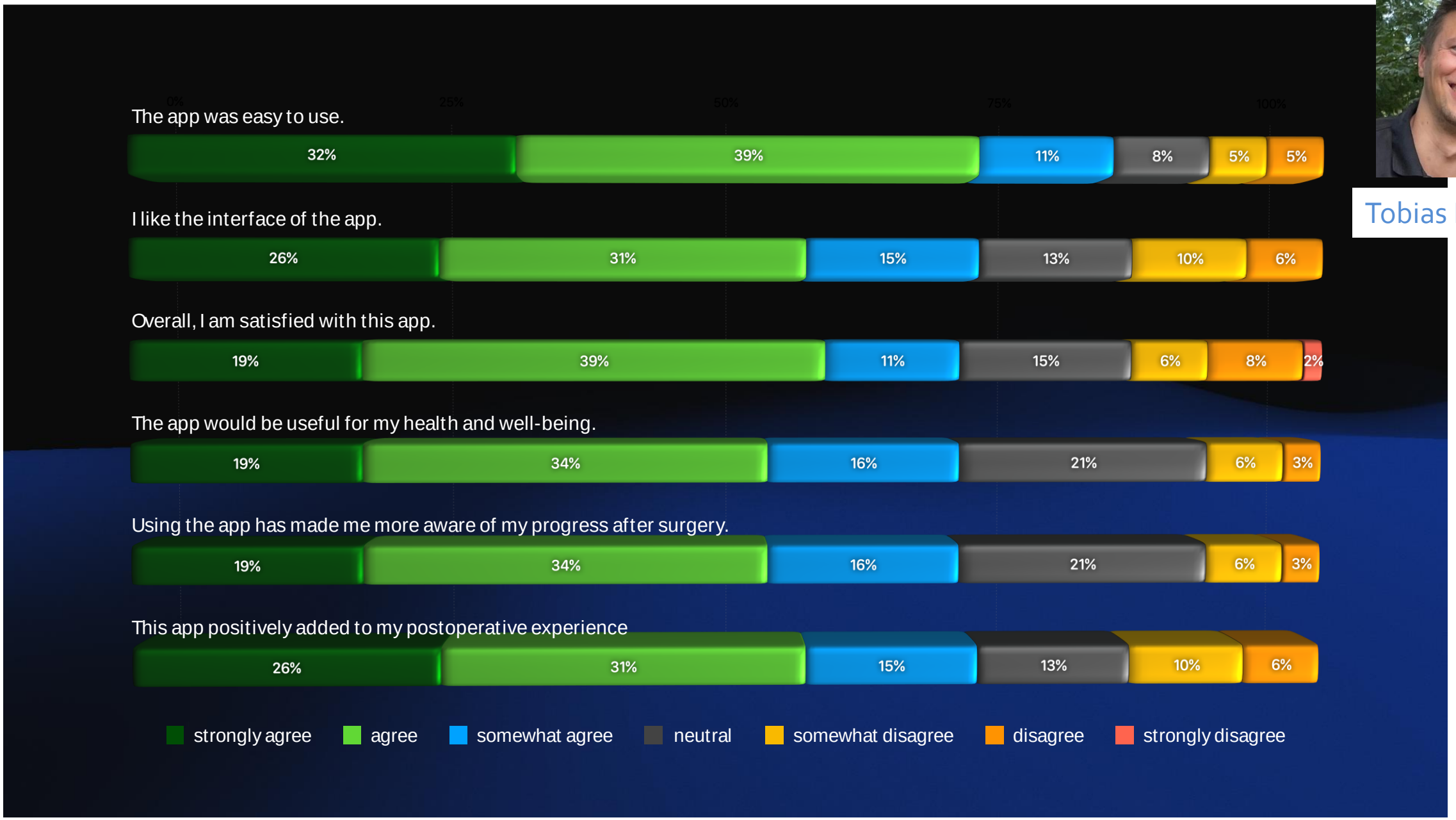
	2/15/2022	3/5/2022	3/6/2022	3/7/2022	3/8/2022	3/9/2022	3/10/2022	3/11/2022	3/12
vas-back	4.0	9.0	6.5	5.5	6.2	6.0	5.0	4.5	4.0
vas-left-leg	4.0	6.0	4.0	2.0	6.0	6.0	6.0	4.2	3.0
vas-right-leg	0.0	6.0	4.0	2.0	5.0	5.0	3.5	3.0	3.0

UW experience with app-based patient follow-up

- 80% of patients agreed that SPINEHealthie was a useful for postoperative care
- Top priorities for patients:
  - Communication with doctor
  - Physical therapy instructions
  - Review of images



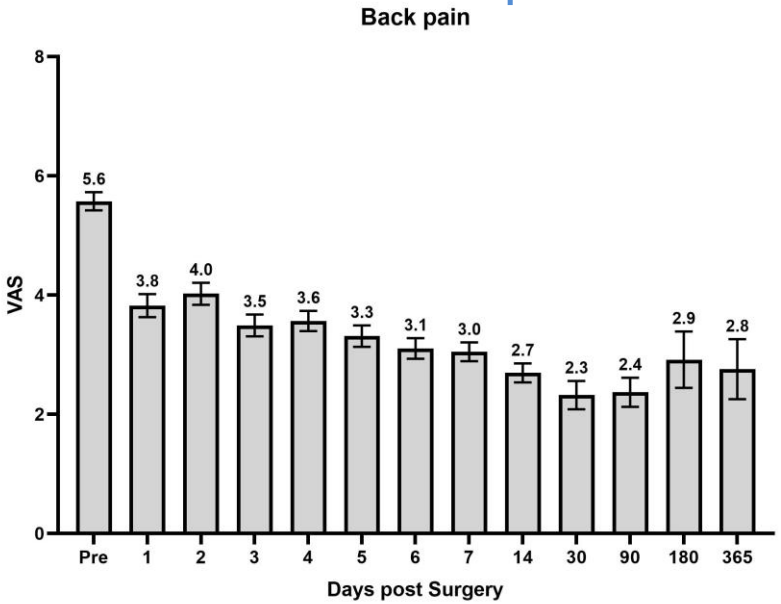
Tobias Prasse, MD

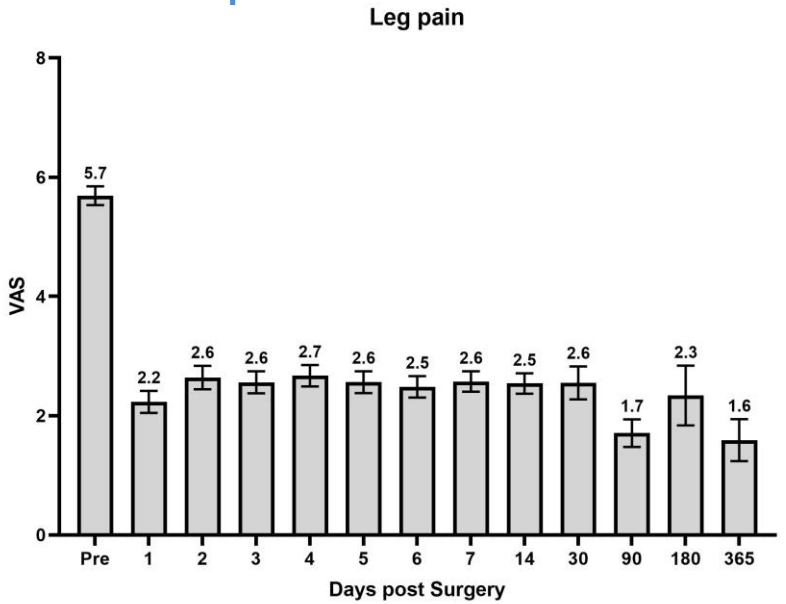


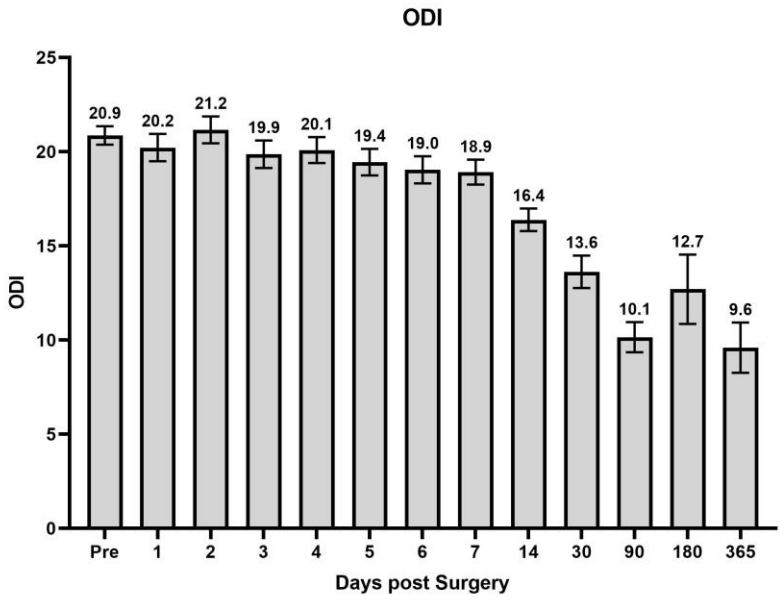
Endoscopic spine surgery is effective

Jannik Leyendecker

- 442 patients prospectively monitored with SPINEHealthie (388 lumbar)
- Immediate reduction of back pain and leg pain within days after surgery
- Functional improvement follows pain alleviation





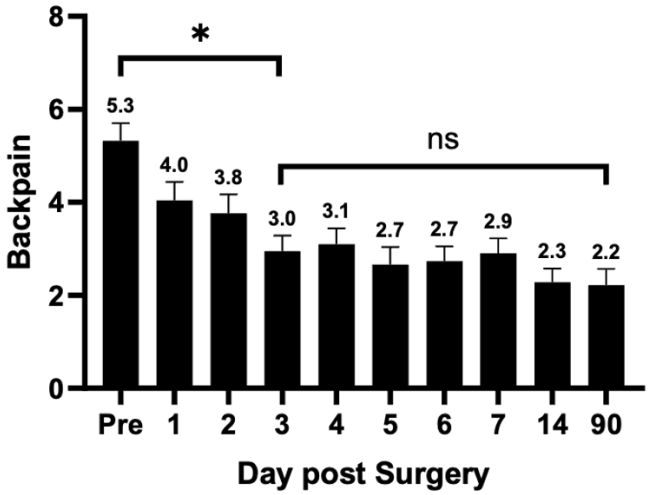


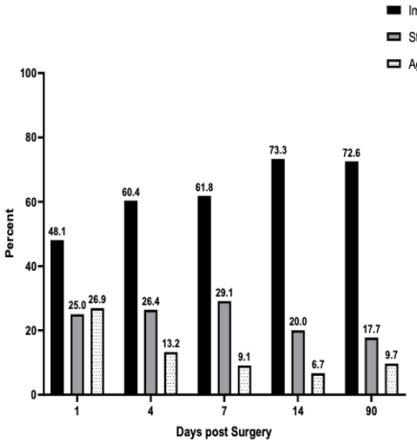
ESRG Ultra early PROMs – discectomy

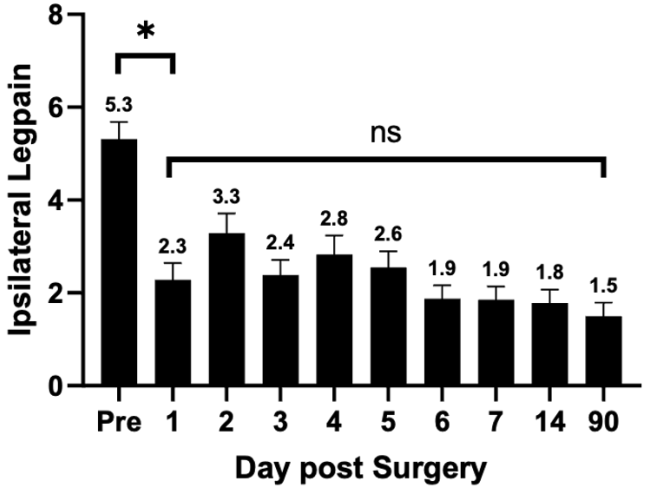
Jannik Leyendecker

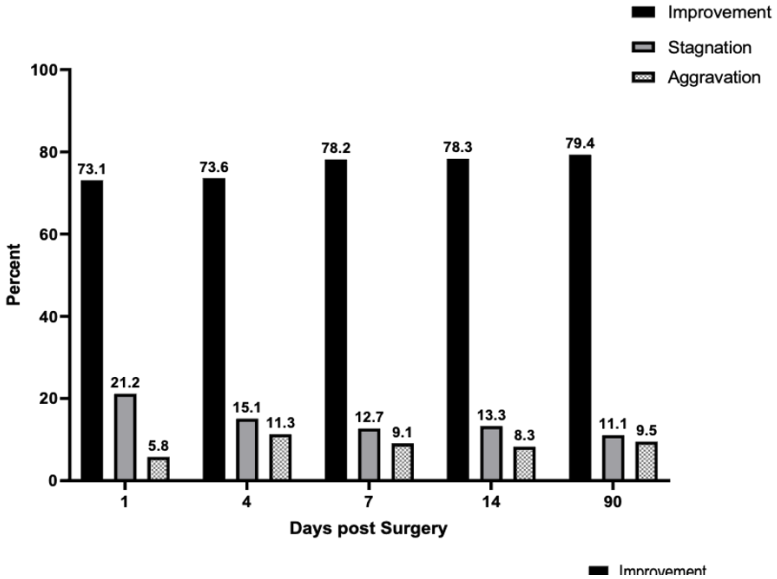
88% of patients who have early improvement (first 3 postop days) report improvement of back pain

95% of patients who have early improvement (first 3 postop days) report improvement of leg pain

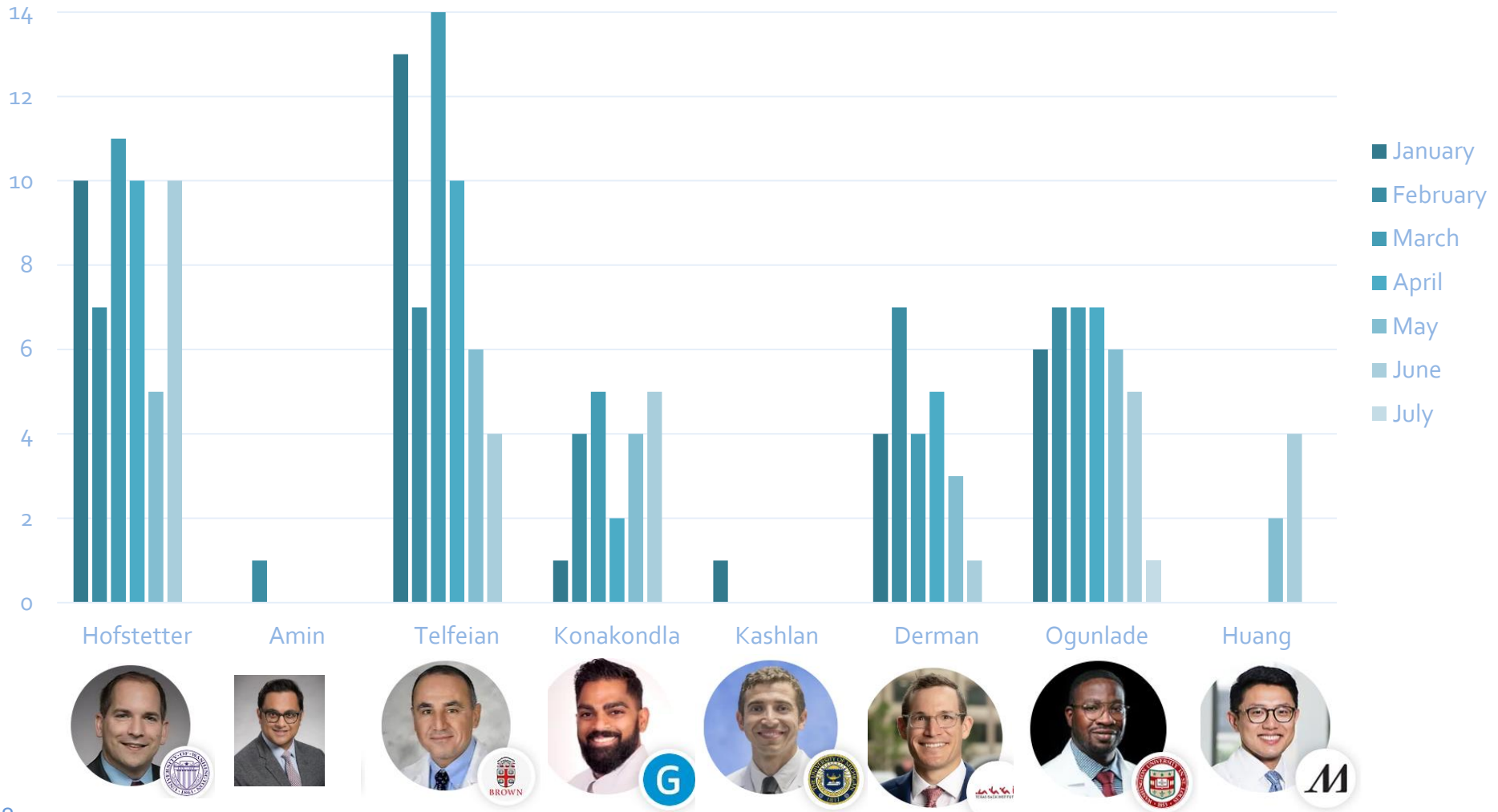








ESRG – cases by surgeon
January-July 2023



Endoscopic Spine Surgery – A Paradigm Shift in Spine Care

- *Establish and teach full-endoscopic procedures*
- *Elevate endoscopic spine surgery as standard of care*
- *Make spine care more enjoyable for patients and surgeons*
- *The vision*

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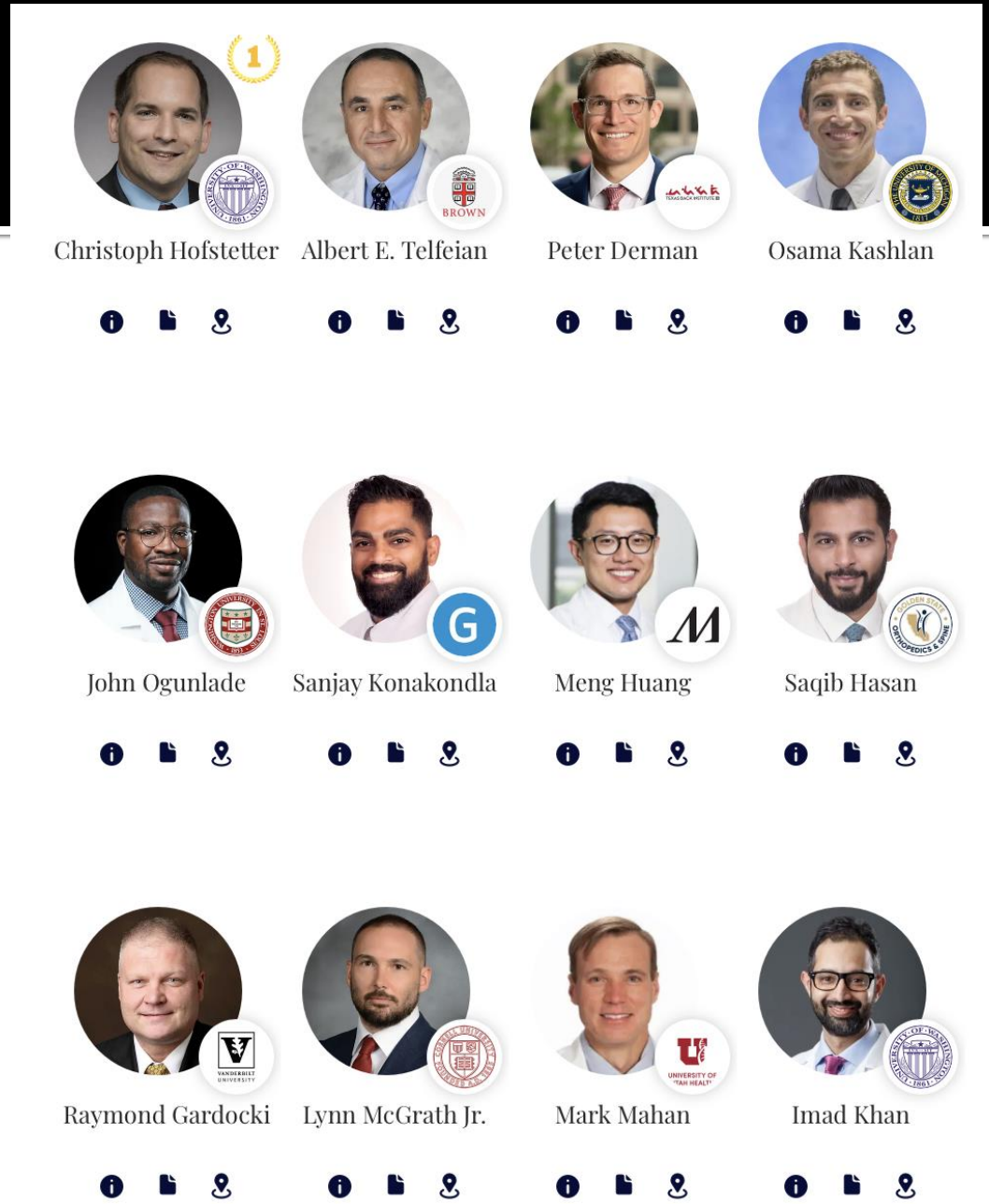
ESRG Vision

- Decrease the burden of manual documentation using an app-based patient care companion (SPINEHealthie).
- Define benchmark outcomes following full-endoscopic spine surgery.
- Quality improvement efforts of surgical and perioperative care.
- Implement AI-based solutions for medical documentation and communication.



Thank you

Questions?