Randomized Controlled Trial: Lumbar Medial Branch Cryoneurolysis Versus Radiofrequency Ablation for Chronic Low Back Pain

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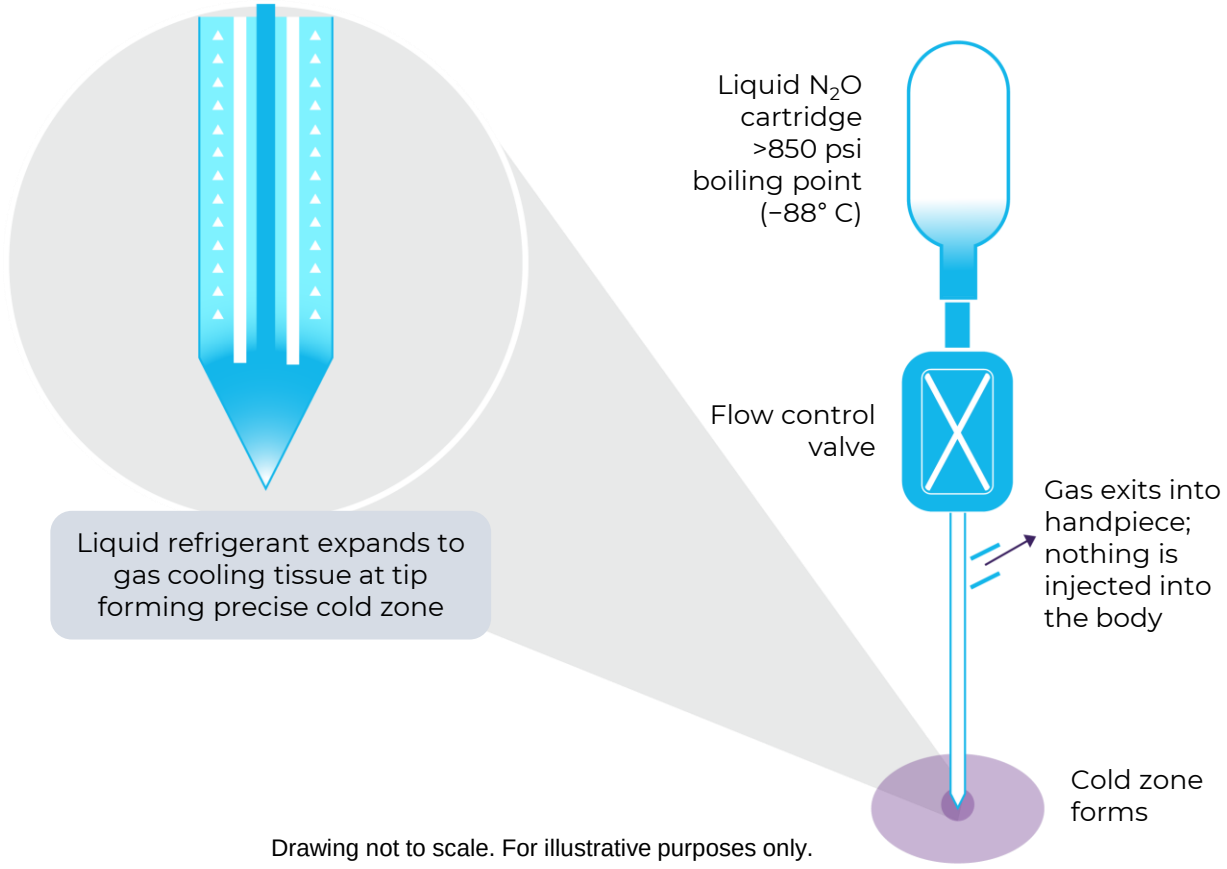
Introduction

- Chronic low back pain is a common condition often treated with RFA[1,2]
  - However, RFA can be destructive to tissue surrounding the targeted nerves[2]
- Cryoneurolysis is an alternative treatment to RFA that applies cold temperatures (between −60°C and −88°C near the targeted nerve) to disrupt nerve conduction pathways via Wallerian degeneration, allowing for nerve regrowth[3-6]
  - Effects can be prolonged for several months in some cases[7]
- Currently, the data for treatment of low back pain via cryoneurolysis are sparse

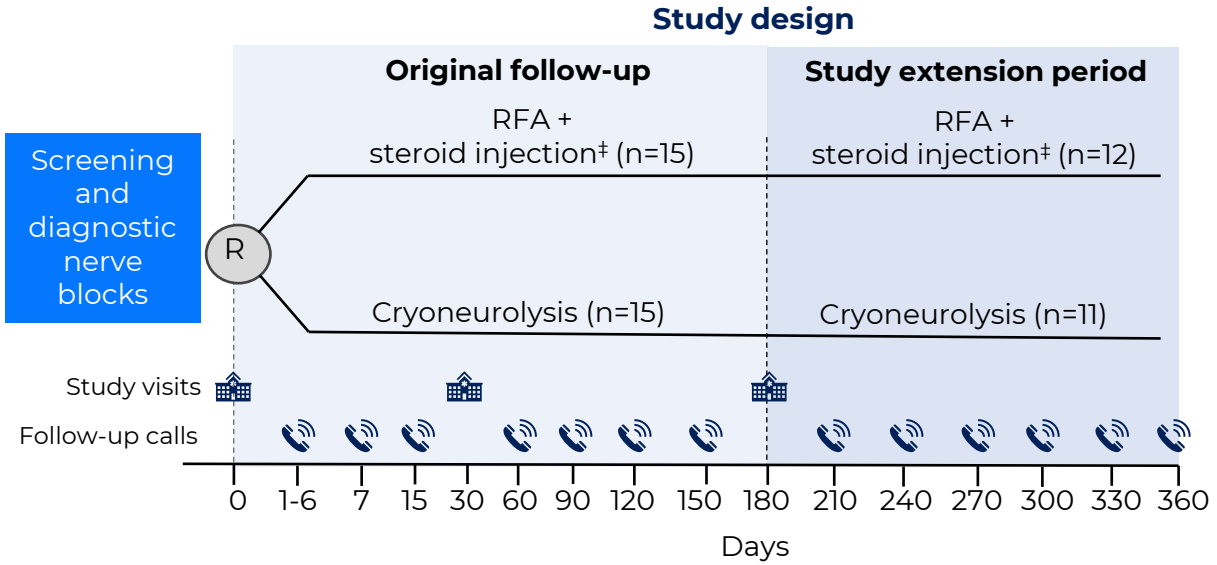
Objective: This pilot study compared the effect of cryoneurolysis versus RFA for treatment of chronic low back pain



RFA, radiofrequency ablation.

1. Airaksinen O et al. *Eur Spine J*. 2006;15(suppl 2):S192-S300. 2. Wray JK et al. Radiofrequency ablation. In: *StatPearls*. Treasure Island, FL: StatPearls Publishing; 2023. 3. Guirguis M et al. Cryotherapy. In: Deer TR et al, eds. *Deer's Treatment of Pain*. Cham, Switzerland: Springer Nature Switzerland AG; 2019. 4. Rubenstein J et al. *Am J Phys Med Rehabil*. 2021;100(5):e65. 5. Winston P et al. *Arch Rehabil Res Clin Transl*. 2019;1:100030. 6. Shaffer JP et al. *Orthop J Sports Med*. 2022;10(5):23259671221096095. 7. Radnovich R et al. *Osteoarthritis Cartilage*. 2017;25(8):1247-1256.

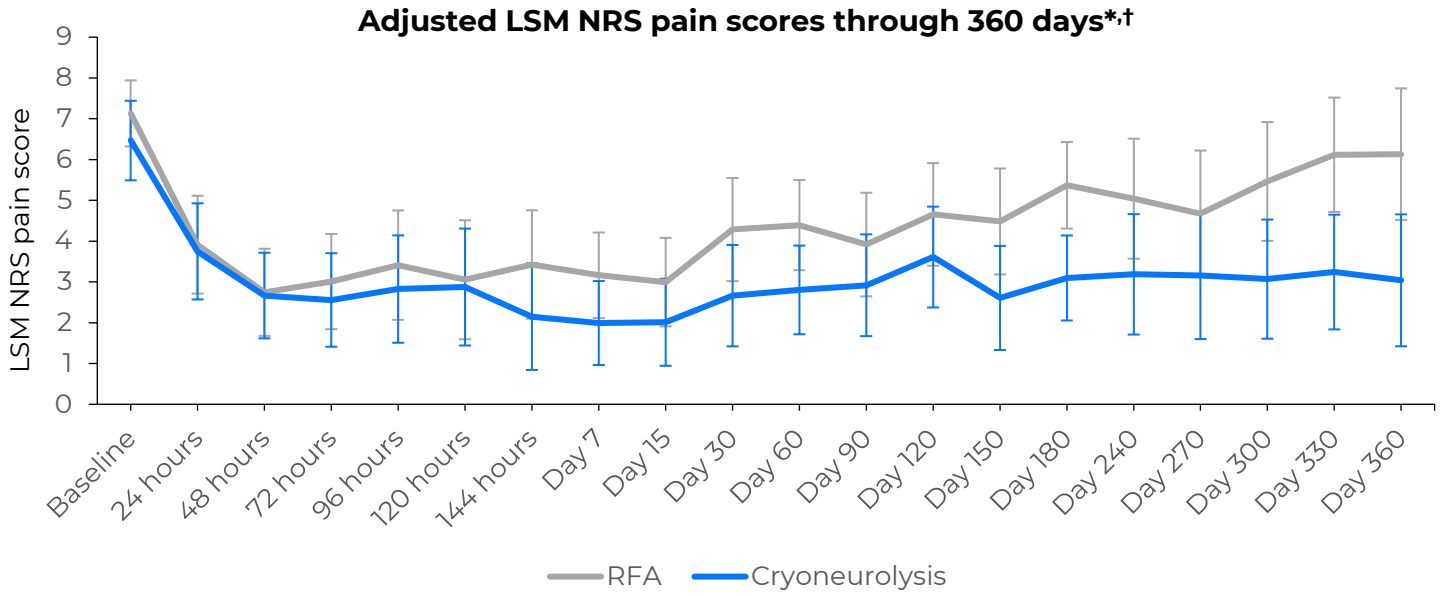
Methods: Study Design



Outcome	Measure*
Pain	Pain scores on NRS
Functional disability status	Oswestry Disability Index
Global impression of change	Patient's Global Impression of Change
Satisfaction with pain management	Participant satisfaction†
Safety	Adverse events

- This single-center randomized controlled trial (NCT06016127) included participants with facet-mediated chronic low back pain
- Eligible participants underwent at least 2 positive diagnostic medial branch blocks with local anesthetic only (ie, no steroids) under fluoroscopic guidance resulting in ≥50% relief of primary (index) pain for the duration of the local anesthetic used
- Participants underwent lumbar RFA with a steroid injection‡ or cryoneurolysis of the lumbar medial branch nerve from L4 to S1

*Least squares mean was calculated after adjusting for baseline NRS, sex, and tobacco use. †Measured on a 5-point Likert scale from extremely dissatisfied (1) to extremely satisfied (5). Participants who scored a 4 (satisfied) or 5 (extremely satisfied) were defined as satisfied for the current analysis. ‡Consisting of 3 mL of 0.25% bupivacaine, 2 mL of 1% lidocaine, and 1 mL of 40 mg/mL triamcinolone, divided and injected at each level.
NRS, numerical rating scale; RFA, radiofrequency ablation.



	LSM NRS pain scores	*P* value
180 days		
RFA (95% CI; n=15)	5.4 (4.3, 6.4)	
Cryoneurolysis (95% CI; n=15)	3.1 (2.1, 4.1)	
LSM difference (95% CI)	-2.1 (-3.6, -0.5)	**0.01**
360 days		
RFA (95% CI; n=12)	6.1 (4.5, 7.7)	
Cryoneurolysis (95% CI; n=11)	3.0 (1.4, 4.7)	
LSM difference (95% CI)	-2.7 (-4.7, -0.7)	**0.01**

Results: Pain Outcomes

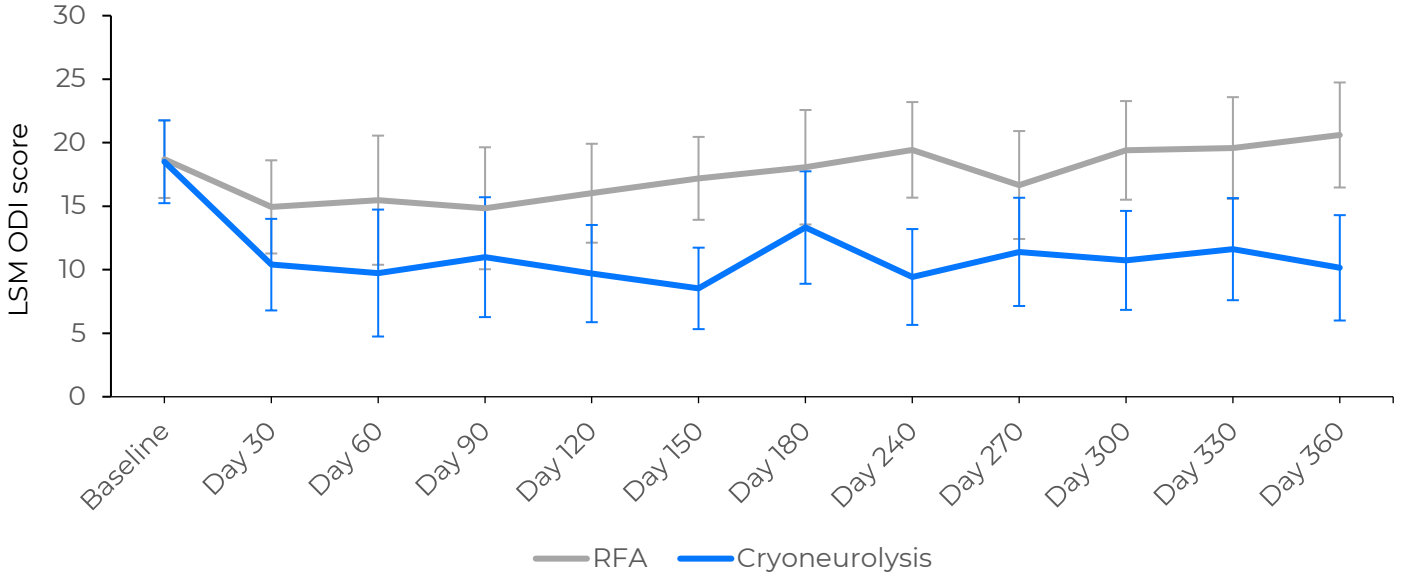
- Adjusted LSM NRS pain scores were numerically higher with RFA versus cryoneurolysis after Day 7 of treatment
- Cryoneurolysis was associated with a significant decrease in NRS pain scores versus RFA at 180 and 360 days

*Data for Day 210 excluded because of multiple missing values. †Baseline mean was not adjusted for covariates, including baseline, gender, smoking status.
LSM, least squares mean; RFA, radiofrequency ablation.

Results: ODI Outcomes

- At Day 360, ODI scores were significantly lower with cryoneurolysis versus RFA

Adjusted LSM ODI scores through 360 days*,†



	LSM ODI score	*P* value
180 days		
RFA (95% CI; n=15)	18.1 (13.6, 22.6)	
Cryoneurolysis (95% CI; n=15)	13.3 (8.9, 17.8)	
LSM difference (95% CI)	-4.8 (-11.4, 1.9)	0.15
360 days		
RFA (95% CI; n=12)	20.6 (16.5, 24.7)	
Cryoneurolysis (95% CI; n=11)	10.2 (6.0, 14.3)	
LSM difference (95% CI)	-10.5 (-16.6, -4.4)	**0.002**

*Data for Day 210 excluded because of multiple missing values. †Baseline mean was not adjusted for covariates, including baseline, gender, smoking status.
LSM, least squares mean; ODI, Oswestry Disability Index; RFA, radiofrequency ablation.

Results: Change in Disability Status

Time and treatment	n	No disability, n (%)	Mild, n (%)	Moderate, n (%)	Severe, n (%)	Completely disabled, n (%)
Baseline						
RFA	15	0	3 (20.0)	10 (66.7)	2 (13.3)	0
Cryoneurolysis	15	0	5 (33.3)	6 (40.0)	4 (26.7)	0
Day 60						
RFA	15	3 (20.0)	8 (53.3)	2 (13.3)	1 (6.7)	1 (6.7)
Cryoneurolysis	15	5 (33.3)	5 (33.3)	2 (13.3)	3 (20.0)	0
Day 180						
RFA	15	**0**	7 (46.7)	5 (33.3)	3 (20.0)	0
Cryoneurolysis	15	**4 (26.7)**	3 (20.0)	6 (40.0)	2 (13.3)	0
Day 270						
RFA	12	**1 (8.3)**	5 (41.7)	5 (41.7)	1 (8.3)	0
Cryoneurolysis	11	**2 (18.2)**	5 (45.5)	4 (36.4)	0	0
Day 360						
RFA	12	**0**	5 (41.7)	5 (41.7)	2 (16.7)	0
Cryoneurolysis	11	**1 (9.0)**	5 (45.5)	5 (45.5)	0	0

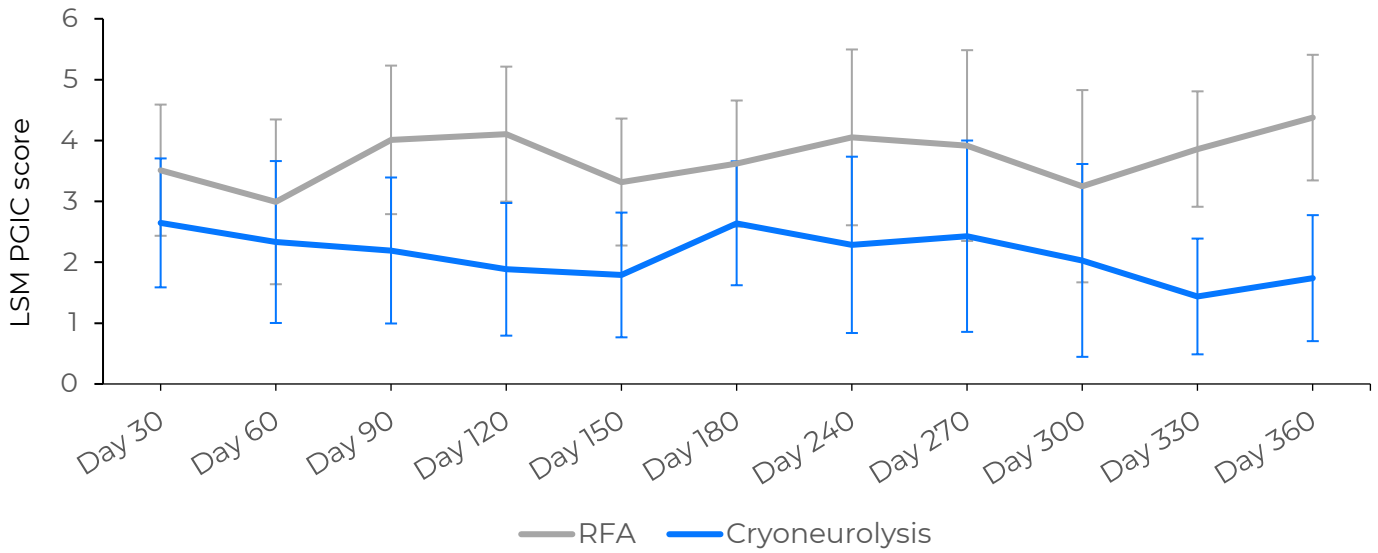
- More participants receiving cryoneurolysis had “no disability” at Day 180, 270, and 360 than those receiving RFA

RFA, radiofrequency ablation.

Results: PGIC Outcomes

- Cryoneurolysis was associated with significant PGIC improvements versus RFA at Day 360

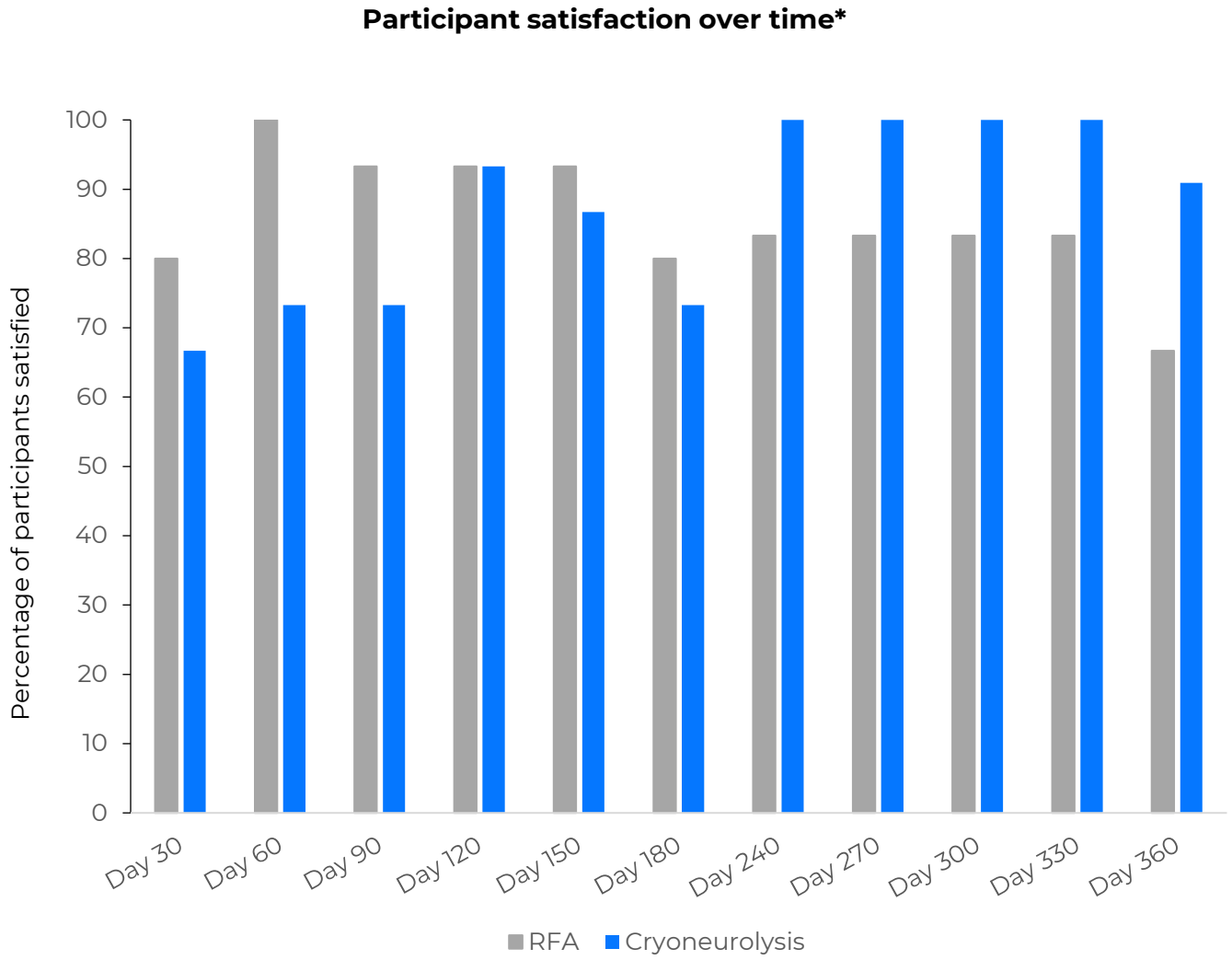
Adjusted LSM PGIC score through 360 days*



	LSM PGIC score	*P* value
180 days		
RFA (95% CI; n=15)	3.6 (2.6, 4.7)	
Cryoneurolysis (95% CI; n=15)	2.6 (1.6, 3.7)	
LSM difference (95% CI)	-1.0 (-2.5, 0.6)	0.20
360 days		
RFA (95% CI; n=12)	4.4 (3.3, 5.4)	
Cryoneurolysis (95% CI; n=11)	1.7 (0.7, 2.8)	
LSM difference (95% CI)	-2.6 (-4.2, -1.1)	**0.002**

*Data for Day 210 excluded because of multiple missing values.
LSM, least squares mean; PGIC, Patient's Global Impression of Change; RFA, radiofrequency ablation.

Results: Participant Satisfaction



- More participants were satisfied with pain management after cryoneurolysis than with RFA from Day 240 through Day 360

*Data for Day 210 excluded because of multiple missing values.
RFA, radiofrequency ablation.

Results: Safety and Additional Spinal Injection

- No serious adverse events were observed over the course of the study
- One mild adverse event was reported (compression fracture in the cryoneurolysis group) and was considered unrelated to study treatment by the investigator
- After Day 180, 54.5% of participants in the cryoneurolysis group did not require an additional spinal injection versus 25% of participants in the RFA group
  - 45.5% of participants in the cyroneurolysis group and 75% of participants in the RFA group required ≥1 additional spinal injection*

Additional spinal injection after Day 180	RFA (n=12)	Cryoneurolysis (n=11)
Additional spinal injection, n (%)	9 (75%)	5 (45.5%)
Lumbar spine, n	8	7
Cervical, n	3	0
Thoracic, n	1	0

*Facet, epidural, or spinal trigger point.
RFA, radiofrequency ablation.

Conclusions

Participants who received cryoneurolysis without a steroid injection for low back pain had significant improvements in pain, disability, and overall impression of treatment at Day 360 compared with participants who received RFA with a concomitant steroid injection

Additionally, participants who received cryoneurolysis were more satisfied with their pain management than those who received RFA

More participants who received RFA required additional spinal injections after Day 180 compared with those who received cryoneurolysis

A large multicenter trial is warranted to confirm these results and further investigate the effects of cryoneurolysis on low back pain

Backup

Results: Baseline Characteristics

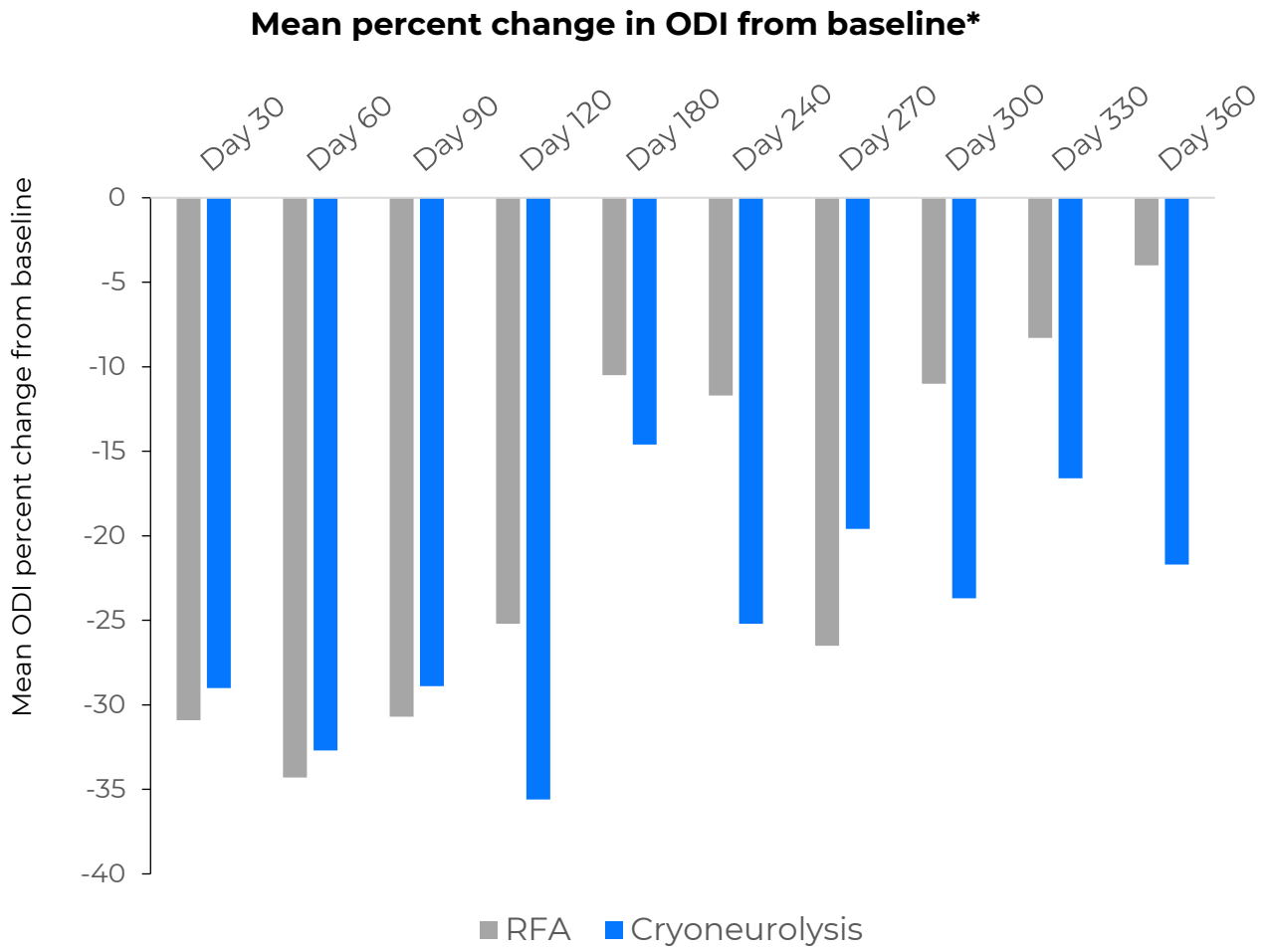
- Of 30 total participants, 15 received RFA and 15 received cryoneurolysis
- After the diagnostic nerve block administered before study treatment, participants in the cryoneurolysis group had 87.3% relief and participants in the RFA group had 95.0% relief
- Age, BMI, back pain duration, and baseline Oswestry Disability Index scores were similarly distributed between groups
- Participants in both groups received spine injections within the last 12 months
- After 180 days, 12 participants in the RFA group and 11 participants in the cryoneurolysis group continued in the follow-up extension period

	RFA (n=15)	Cryoneurolysis (n=15)	Total (N=30)
Demographic and baseline characteristics			
Age, mean (SD), y	63.1 (12.7)	66.0 (17.1)	64.5 (14.9)
Sex, n (%)			
Male	7 (46.6)	9 (60.0)	16 (53.3)
Female	8 (53.3)	6 (40.0)	14 (46.7)
BMI, mean (SD), kg/m^2	28.1 (5.0)	26.5 (6.4)	27.3 (5.7)
White race, n (%)	15 (100.0)	15 (100.0)	30 (100.0)
Not Hispanic or Latino, n (%)	15 (100.0)	15 (100.0)	15 (100.0)
Duration of low back pain, mean (SD), y[a]	19.6 (16.2)	24.9 (19.7)	22.7 (18.2)
Pain score on NRS, mean (SD)	7.1 (1.6)	6.5 (1.9)	6.8 (1.8)
Spinal injection history			
Any spine injections, n (%)	14 (93)	15 (100)	29 (97)
Lumbar spine	14 (93)	14 (93)	28 (93)
Cervical	1 (7)	3 (20)	4 (13)
Sacrum	1 (7)	1 (7)	2 (7)
Lumbar spine injection, n (%)			
Epidural	4 (27)	9 (60)	13 (43)
Facet	10 (67)	12 (80)	22 (73)
Other	1 (7)	0	1 (3)

[a]RFA (n=10); cryoneurolysis (n=14); total (n=24).

BMI, body mass index; NRS, numerical rating scale; RFA, radiofrequency ablation; SD, standard deviation.

Results: ODI Outcomes



- The mean percent decrease in ODI score from baseline was greatest at Day 360 for cryoneurolysis compared with RFA

*Data for Day 210 excluded because of multiple missing values.
ODI, Oswestry Disability Index; RFA, radiofrequency ablation.