**A Systematic Review of Head-to-Head Evidence for Comparing Transforaminal Epidural Steroid Injections to Interlaminar Epidural Steroid Injections for the Treatment of Lumbosacral Radicular Pain.**

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**Objective:** Controversy exists regarding superiority of TFESI or ILESI for the treatment of lumbosacral radicular pain (LSRP). We systematically reviewed studies directly comparing transforaminal epidural steroid injection (TFESI) to interlaminar epidural steroid injection (ILESI) for the treatment of LSRP. No such review currently exists.

**Design:** PubMed® and Google Scholar® were comprehensively searched to identify studies comparing TFESI to ILESI for LSRP, prior to 2013. Studies that met Cochrane Review criteria for randomized trials and Agency for Health Care Quality criteria for observational studies were included.

**Setting:** n/a

**Main Outcome Measures:** Evidence was graded according to the USPSTF classification. Level 1, II-1, II-2, II-3, and III requires at least 1 randomized controlled trial (RCT) (1), non-randomized controlled trials (II-1), controlled retrospective studies (RS) (II-2), uncontrolled RSs (II-3), and descriptive studies (III). Clinical significance was defined by pain and functional score improvements greater than 20% and 10%, respectively, consistent with Cochrane review guidelines. 6 months was defined as "long-term."

**Results or Clinical Course:** 10 studies met the required criteria. For LSRP due to disc herniation (DH), level 1 evidence exists for clinically significant short (2 RCTs, 1 RS) and long-term (2 RCTs) improvement in pain scores with TFESI compared to ILESI. These findings are opposed by level 1 evidence for no difference between groups in the short (2 RCTs) and long-term (2 RCTs). Level 1 evidence exists for improvement in short (1 RCT) and long-term (2 RCTs) disability with TFESI compared to ILESI. These findings are opposed by level 1 evidence for no difference between groups in the short (2 RCTs) and long-term (1 RCT). In the treatment of LSRP due to spinal stenosis (SS), one RS comparing TFESI to ILESI showed no difference in short term pain or functional outcomes.

**Conclusions:** For the treatment of LSRP due to DH, Level 1 evidence exists ranging from no difference between TFESI and ILESI to clinically significant improvements in both short and long-term pain and functional outcomes. Therefore, this review suggests that TFESI is moderately superior to ILESI for short and long-term treatment of pain and disability. For the treatment of LSRP due to SS, no head-to-head evidence exists for superiority of either approach.
Effects of Cervical Extension on Deformation of Intervertebral Disc and Migration of Nucleus Pulposus

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501. Best Pain and Spine Medicine Research Podium Presentations
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• Level of Evidence: 4
Pain from Cervical Spine

- Pain originated from the cervical spine is one of the major health problems in modern society.
  - 51% of people suffer from neck pain in a general population (Van der Donk, Schouten et al. 1991)
  - Main cause of the neck pain has been considered to be the structural abnormalities of intervertebral disc, e.g. disc herniation (Milette, Fontaine et al. 1999)
Extension Exercise

- The extension exercise so-called ‘McKenzie maneuver’ has been reported to have pain relieving effect. (Smith and Mell 1987, Highland, Dreisinger et al. 1992, Kjellman and Oberg 2002, Dionne et al. 2006)

- Therapeutic mechanism underlying the cervical extension exercise?
- Biomechanical aspects of the cervical spine subjected to the extension?
Objectives

• To investigate the effects of cervical extension maneuver on cross-sectional morphological changes:

1) Deformation of IVD (Intervertebral Disc);
2) Migration of NP (Nucleus Pulposus) in IVD;
3) Posterior Bulge of AF (Annulus Fibrosus);
4) Correlation between NP migration and Extension angle;
5) Cross-sectional morphological change of NP
Method

- 10 young, healthy male participants (22.4 ± 1.6 years old)
- No history of
  - Trauma or inflammation
  - Pain for > 48 hrs. in post neck or shoulder girdle
- Can tolerate Cervical extension for > 5min

- Midline sagittal T2 MR in neutral and extended postures
Heights of IVD’s outer and inner boundaries were measured at same positions (1/4, 2/4, 3/4 of IVD length) for neutral / extension states.
Data Analysis 2: Migration of NP

Posterior Vertebral Line (PVL)

$L_{IVD}$

$L_{NP}$

$L_{AF}^\text{ant}$

$L_{AF}^\text{post}$

$L_{PAF}^\text{bulge}$

$PVL$ (Posterior Vertebral Line)
Data Analysis 3: Correlation between NP Migration and Extension Angle

1) Definition of Inter-segmental Angle
2) Definition of Segmental Extension Angle
3) NP migration VS. Segmental Extension Angle
Data Analysis 4: Morphological Change of NP

Method for Extracting NP Contours
Comparing NP contours of each state for analysis of cross-sectional morphological change of NP.

NP contours of Neutral / Extension were superimposed by their centres on the sagittal plane to be compared.
Statistical Analysis

- Statistical significance on deformation of IVD/NP and migration of NP was assessed by Paired T-test.
- **Pearson Correlation Analysis** was performed for the relationship between NP migration and inter-segmental extension angle.
Results
Result 1: Deformation of IVD’s Outer Boundary

(a) C3-C4
(b) C4-C5
(c) C5-C6
(d) C6-C7
Result 1:
Deformation of IVD’s Inner Boundary

(a) C3-C4
(b) C4-C5
(c) C5-C6
(d) C6-C7

IVD inner height (mm)

IVD Position

Neutral
Extension

**
Result 2: Migration of NP
Result 3: Correlation between NP Migration and Segmental Extension Angle

\[ r_{xy} = 0.9677 \]

\[ r_{xy} = 0.8525 \]

\( r_{xy} \): Pearson’s Correlation Coefficient
Result 4: Morphological Change of NP

Cross-sectional morphology change of NP on the mid-sagittal plane

(a) C3-C4

(b) C4-C5

(c) C5-C6

(d) C6-C7
Conclusions

• At cervical extension,

1) **Anterior height of IVD increases** significantly at C3-C4 and C4-C5 for both outer and inner boundaries.

2) Posterior margin of **NP migrates anteriorly** in the IVD, where the amount of migration was greater at C3-C4, C4-C5 than C5-C6, C6-C7.

3) Posterior margin of **AF protrudes posteriorly** at C3-C4 and C4-C5, while the cross-sectional length of posterior AF increases at all levels.

4) Significant **linear correlation** exists between **NP migration** and **extension angle**.

5) Cross-sectional **morphological change of NP occurs** as well as the anterior migration:
   a) anterior height of NP increases, which was significant at C3-C4, C4-C5.
   b) cross-sectional length and posterior height of NP slightly decrease.
Thank You