

# INPLASY PROTOCOL

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None declared.

## Comparison of in vivo intradiscal pressure between sitting and standing in human lumbar spine: A systematic review and meta-analysis

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**Review question / Objective:** The primary objective of this systematic review is to compare the differences in vivo IDP between sitting and standing postures. The secondary objective of this review is to compare effect size estimates between 1) dated and more recent studies and 2) healthy and degenerated intervertebral discs.

**Condition being studied:** Healthy adults, patients with low back pain.

**Eligibility criteria:** Studies were included in the review if they 1) involved in vivo IDP measurement in both sitting and standing postures, 2) involved measurements with intervertebral body replacement and 3) included spinal loading data of healthy adults. Studies were excluded if they 1) investigated in vitro measurement of IDP, 2) did not report the central tendency and/or variability of the outcome of interest and 3) were letters to the editor, case studies, case series or review articles. For the relevant papers that did not provide sufficient data, we contacted the corresponding author to acquire the data.

**INPLASY registration number:** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 11 March 2022 and was last updated on 11 March 2022 (registration number INPLASY202230043).

### INTRODUCTION

**Review question / Objective:** The primary objective of this systematic review is to compare the differences in vivo IDP between sitting and standing postures. The secondary objective of this review is to compare effect size estimates between 1)

dated and more recent studies and 2) healthy and degenerated intervertebral discs.

**Rationale:** The limitation in measurement technology could be a confounding factor that affects the accuracy of the IDP measure. For example, the insertion of a

needle transducer will result in abnormal muscle contraction when changing postures. To date, no study has evaluated the effect of sitting and standing on IDP using a meta-analysis. Therefore, this study aims to estimate the effect size of lumbar IDP in vivo measurement in sitting compared to standing posture. This study will also compare the effect size estimate between 1) dated and more recent studies and 2) healthy and degenerated IVDs.

**Condition being studied:** Healthy adults, patients with low back pain.

## METHODS

**Search strategy:** A systematic search was performed for articles published before November 2021, and there was no restriction on the earliest publication date. Six electronic databases, namely, Google Scholar, Scopus, PubMed, Web of Science, EMBASE and Cochrane Library, were used to search for the related articles. The keywords used in the literature search included healthy adults, sitting posture, standing posture, in vivo spinal loads and in vivo IDP. Hand searching was also performed for related articles to obtain supplementary information. The reference lists of the included studies were reviewed (backward tracking), and literature citing the included studies were tracked (forward tracking) to identify additional studies.

**Participant or population:** Healthy adults, patients with low back pain. No limitation on gender and ethnicity.

**Intervention:** Change of position (sitting and standing).

**Comparator:** Not applicable.

**Study designs to be included:** Cross-sectional study, RCT.

**Eligibility criteria:** Studies were included in the review if they 1) involved in vivo IDP measurement in both sitting and standing postures, 2) involved measurements with intervertebral body replacement and 3) included spinal loading data of healthy

adults. Studies were excluded if they 1) investigated in vitro measurement of IDP, 2) did not report the central tendency and/or variability of the outcome of interest and 3) were letters to the editor, case studies, case series or review articles. For the relevant papers that did not provide sufficient data, we contacted the corresponding author to acquire the data.

**Information sources:** Six electronic databases, namely, Google Scholar, Scopus, PubMed, Web of Science, EMBASE and Cochrane Library, were used to search for the related articles.

**Main outcome(s):** In vivo measurements of IDP during sitting or standing over the lumbar spine.

**Data management:** Full-text reviews were performed on the selected articles after the title and abstract screening. Two reviewers extracted the data from articles independently. A standardised data extraction form was used to extract the data from the included studies. The extracted information included the sample size, characteristics of participants (age, gender and disc condition) and outcomes (type of outcome measures and means and standard deviations (SDs) of the outcomes).

**Quality assessment / Risk of bias analysis:** Because all included studies were cross-sectional studies and no standard assessment tools were used to assess their quality, we referenced an approach developed by Friedemann et al. that mainly considers five elements: (1) blinding of outcome assessment, (2) incomplete outcome data, (3) selective reporting, (4) precision of measurement methods and (5) representative samples. Each of these outcomes is given a mark, resulting in a maximum of 5 marks for a cross-sectional study. We classified a paper as having moderate quality if it scored 3 or more marks. Studies with a quality score below 3 were considered low quality and were not included in the meta-analysis.

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**Strategy of data synthesis:** The primary outcome measures were direct measures of the participants' IDP or force at the lumbar level. Mean values and the SDs of the IDP were used to estimate the effect size. The statistical analyses were performed using the R language and the Meta package.

**Subgroup analysis:** 3 subgroup analyses were conducted 1) an analysis of the differences between study published before and after 1990. 2) an analysis of the differences between normal and degenerated discs. And 3) an analysis of the differences in loading between L3-4 and L4-5 discs.

**Sensitivity analysis:** A leave-one-out meta-analysis was performed to evaluate the influence of each study on the overall effect size estimate.

**Language:** English, Chinese and Japanese.

**Country(ies) involved:** Hong Kong SAR, Singapore.

**Keywords:** low back pain; intradiscal pressure; in vivo measure; posture.

**Dissemination plans:** The review will be published on peer-reviewed journal

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