

RESEARCH LETTER

Full-endoscopic Transforaminal Discectomy Versus Open Microdiscectomy for Sciatica: Update of a Systematic Review and Meta-analysis

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Percutaneous transforaminal endoscopic discectomy (PTED) was intended as a less invasive surgical technique to treat sciatica caused by a lumbar disk herniation. In contrast to conventional open microdiscectomy, PTED is performed under conscious sedation during which the disk herniation is removed from a transforaminal approach. Furthermore, PTED is performed on an outpatient basis. Concerns, however, exist on its learning curve and effectiveness compared with microdiscectomy.¹ We previously published the results of a systematic review and meta-analysis that relied on available literature in April 2020 and compared clinical outcomes of PTED with those of microdiscectomy.² As the field of endoscopic spine surgery is growing in both clinical practice and research, an update of the previously conducted review is warranted.^{2,3}

MATERIALS AND METHODS

Full methods of the current review have been previously published, and the study protocol was registered in the international prospective register of systematic reviews before the update was commenced (Prospero CRD 42020177053).² In brief, (quasi)randomized controlled trials (RCTs) comparing PTED with open microdiscectomy in clinical outcomes [Visual Analog Scale for leg pain, back

pain, functionality as measured by the Oswestry Disability Index (ODI)] or costs, published in English, Dutch, and German were included. Prospective nonrandomized studies and retrospective studies were excluded for this update, as the level of evidence from these studies is lower than that of RCTs.

An experienced librarian performed a systematic search in multiple online databases such as PubMed, Embase, and MEDLINE on April 1, 2022. Based on these search results, two reviewers independently screened articles, read the full texts, and performed data extraction. A third reviewer was available to solve disagreements. Data extraction and risk of bias assessment of the newly identified articles was performed by two reviewers that were not part of the research group of the current study and thus were independent.

Treatment effects such as leg pain, back pain, and functional status were expressed as standardized mean differences (SMDs) with their 95% confidence intervals (CIs). Treatment effects were estimated at short term (1 d), intermediate term (3–6 mo), and long term (12 mo). Random effect models were used for all analyses, as available on RevMan 5.3 (The Cochrane Collaboration). Statistical heterogeneity was tested by the I^2 . The overall quality of the evidence for the clinical outcomes leg pain, functionality, and back pain was summarized using the GRADE method.

RESULTS

Studies

The updated search resulted in two additional RCTs, which were also included in the meta-analysis. Both RCTs were publications of the same study.^{3–5} Therefore, in addition to the nine (quasi)randomized studies included in the previous meta-analysis, 10 RCTs were included in the current study.² Based on the independent review of the risk of bias of the newly added study of Gadjradj and colleagues had a low level of selection bias and reporting bias, an unknown level of attrition bias, and a high risk of performance and detection bias. Finally, conflict of interest was only apparent evident in one of the studies, which was included in the previous version of the review.

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TABLE 1. GRADE Evidence Summary on the Outcomes of PTED Versus Microdiscectomy

	Quality Assessment							No. of Patients		Effect [SMD (95% CI)]	Quality of Evidence
	No. of Studies	Design	Limitations*	Inconsistency†	Indirectness‡	Imprecision§	Other	PTED	OM		
Leg pain (intermediate term)	5	RCT	No serious limitations*	No serious inconsistency	No serious indirectness	No serious imprecision	No serious considerations	498	570	0.80 (−1.69 to 0.08)	High
Leg pain (long term)	4	RCT	No serious limitations	No serious inconsistency	No serious indirectness	No serious imprecision	No serious considerations	268	356	−0.07 (−0.43 to 0.28)	High
Functional outcome (intermediate term)	4	RCT	Serious limitations*	No serious inconsistency	No serious indirectness	No serious imprecision	No serious considerations	472	546	−0.17 (−0.29 to −0.04)	Moderate
Functional outcome (long term)	3	RCT	No serious limitations	No serious inconsistency	No serious indirectness	No serious imprecision	No serious considerations	237	326	−0.24 (−0.45 to −0.04)	High
Back pain (intermediate term)	2	RCT	No serious limitations	No serious inconsistency	No serious indirectness	No serious imprecision	No serious considerations	224	295	−0.23 (−0.53 to 0.07)	High
Back pain (long term)	2	RCT	No serious limitations	No serious inconsistency	No serious indirectness	No serious imprecision	No serious considerations	219	306	−0.20 (−0.52 to 0.11)	High

*Quality of evidence is downgraded if > 50% of the study population origins of studies with a high risk of bias for allocation concealment.
 †Quality of evidence is downgraded if the I² statistic > 75% or if only 1 study reports on the outcome.
 ‡Quality of evidence is downgraded if study results are not generalizable.
 §Quality of evidence is downgraded if there are <400 patients in the study sample for continuous outcomes or if there are <300 events in the study sample for dichotomous outcomes.
 ||Quality of evidence is downgraded if there are signs of publication bias or conflicts of interest.
 CI indicates confidence interval; OM, open microdiscectomy; PTED, percutaneous transforaminal endoscopic discectomy; RCT, randomized controlled trial; SMD, standardized mean difference.

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Clinical Outcomes

Figure 1A gives an overview of the pooled results of leg pain at short term, intermediate term, and long term. At all three time points, there was no difference in leg pain between patients of the PTED group *versus* microdiscectomy. At 12 months, there was high-level evidence of no difference (SMD: -0.07, 95% CI: -0.43 to 0.28, N=624) between both groups, while showing moderate to substantial statistical heterogeneity (Table 1).

Figure 1B shows the pooled results of the ODI compared between PTED and microdiscectomy at different time points. At short term, there was no difference between both groups. At intermediate-term and long-term patients of the PTED group had lower scores on the ODI and thus better functionality compared with patients of the microdiscectomy group. At 12 months, there was high-level evidence of better functionality in favor of the PTED group (SMD: -0.24,

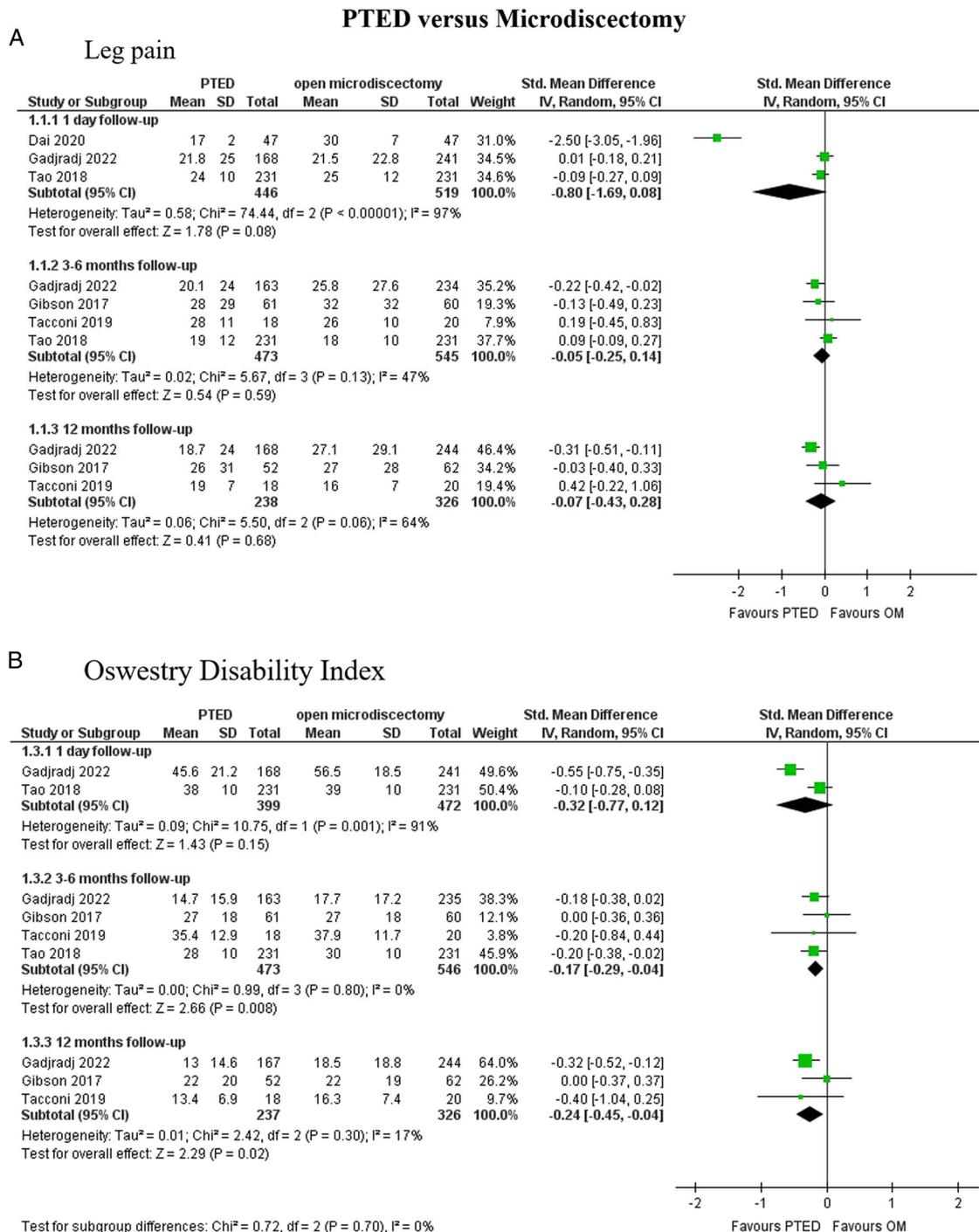


Figure 1. Forrest plots showing pooled data on leg pain (A) and functionality (B) after PTED and microdiscectomy. CI indicates confidence interval; OM, open microdiscectomy; PTED, percutaneous transforaminal endoscopic discectomy.

95% CI: -0.45 to -0.04, N=563), while data showed little statistical heterogeneity (Table 1).

Table 1 further shows the pooled results of back pain measured at intermediate term and long term. At 12 months, there was high-level evidence of no difference in back pain (SMD: -0.20, 95% CI: -0.52 to 0.11) between PTED and microdiscectomy.

Costs and Cost-effectiveness

Three studies reported on the costs of both procedures, while only one prospective study performed a cost-effectiveness analysis. Of these three studies, two reported higher costs of the surgery itself for PTED, while two reported also lower costs for hospitalization for the PTED group. The only study performing a cost-effectiveness analysis showed that aside from the costs of the surgery itself, all other direct and indirect costs for the PTED group were lower than for the microdiscectomy group. Furthermore, it was calculated that the probability of PTED being cost-effective compared with microdiscectomy was 99.4%.⁴

DISCUSSION

The current review and meta-analysis provide a contemporary update of the literature comparing PTED with microdiscectomy in the treatment of sciatica. Based on the inclusion of the new literature, the quality of the evidence as measured by the GRADE method, has increased to high levels of evidence in five domains. This justifies the update of the previous review and provides clinicians and policymakers more guidance on the merits of endoscopic discectomy over conventional techniques. The increase in level of evidence was mainly due to the addition of one robust trial with large sample size and low risk of bias for allocation concealment leading to less serious limitations in the GRADE quality assessment. Furthermore, this update of the meta-analysis confirms other findings of the original review; PTED is associated with shorter length of stay in the hospital, less blood loss, lower rate of

complications, and a higher rate of patient satisfaction.⁶ Strengths of the review include the use of previous methodology and the independent scoring of the new study. Limitations include the statistical heterogeneity of some outcomes and the moderate level of evidence of functionality at the intermediate term.

In conclusion, there is high-quality evidence in the literature regarding equivocal outcomes regarding leg pain reduction for PTED compared with microdiscectomy in both the intermediate term and long term. Furthermore, there was moderate level evidence of better functionality after PTED at the intermediate term and high-level evidence of better functionality after PTED in the long term, compared with microdiscectomy. The effect sizes of these differences, however, are small. Based on the current systematic review and meta-analysis, PTED can be considered a technique with equivalent effectiveness compared with microdiscectomy, with some moderate clinical advantages over microdiscectomy.

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