TURUN YLIOPISTO

Return to Work After Lumbar Microdiskectomy: A Systematic Review and Meta-analysis

Fysiatria
Syventävien opintojen kirjallinen työ

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Tiivistelmä

Tutkimusasetelma: Systemaattinen katsaus ja meta-analyysi.
Tavoite: Selvittää tieteellisen näytön laatua työhön paluusta lannerangan mikrodiskektomian jälkeen.
Taustatietojen yhteenveto: Vaikka lannerangan mikrodiskektomia on laajalti käytetty ja tutkittu toimenpide, näyttö leikkauksen jälkeisestä työhön paluusta ei ole tarkistettu systemaattisen katsauksen keinoin.
Menetelmät: Haku Medline, Embase, Cinahl, Scopus ja Web of Science tietokannoissa. Systemaattisen harhan riskin arviointi Quality in Prognosis Studies (QUIPS) työkalua käyttäen. Satunnaisvaikutusten meta-analyysi ja metaregressio. Aineisto koostui aikuisista, jotka ovat läpikäyneet lannerangan mikrodiskektomia välilevyn tyrän vuoksi. Selkäydinkanavan stenoosi, perkutaaninen diskektomiaa, keinovälilevy, laminektomia, luudutus sekä leikkaus ratsupaikkaoireyhtymän vuoksi olivat pois suljettu.
Tulokset: Tunnistetusta 2.285 julkaisusta 31 sisällytettiin meta-analyysiin. Useimpien tutkimusten systemaattisen harhan riski oli todettu vähäiseksi. 21 tutkimuksen tulosten perusteella leikkauksen jälkeisen työhön paluun keskimääräinen esiintyvyys oli 78 % (95 %:n luottamusväli 71 % – 83 %). 13 tutkimuksen tulosten perusteella työhön paluun keskimääräinen aika oli 4,79 (95 %:n luottamusväli 3,88 – 5,70) viikkoa. Työhön paluun esiintyvyyden metaregressioanalyysi seurata-ajan mukaan johti merkitsevään, mutta pieneen kertoimeen 0,02 (95 %:n luottamusväli 0,01 – 0,03, p=0,006). Kaikissa kolmessa mallissa oli huomattavaa heterogeenisyyttä.
Johtopäätös: Tämän katsauksen tulokset viittaavat siihen, että noin 70–80 % potilaista, joille tehdään mikrokirurginen välilevyn tyrän toimenpide, palaa työhön ensimmäisen puolentoista kuukauden kuluessa. Näyttää myös siltä, että työhön paluu tämän ajanjakson jälkeen on melko epätodennäköistä. Leikkausta edeltävien oireiden kesto ei vaikuttanut merkittävästi työhön paluun esiintyvyyteen. Tiedot näistä trendeistä tulisi ottaa huomioon sekä toimenpiteen suunnitteluvaiheessa että leikkauksen jälkeisen kuntoutuksen tavoitteita asetettaessa.

Avainsanat: diskektomia, mikrokirurgia, nikamavälilevyn rappeuma, työhön paluu

Abstract

Study Design: Systematic review and meta-analysis.

Objective: To investigate evidence on the prevalence and timeline of RTW after lumbar microdiskectomy.

Summary of Background Data: While lumbar microdiskectomy is a widely used and well-studied procedure, there is lack of evidence on the postoperative prevalence and schedule of return to work after this type of surgery.

Methods: Search at Medline, Embase, Cinahl, Scopus and Web of Science. Assessment of risk of systematic bias using Quality in Prognosis Studies (QUIPS). Random effects meta-analysis and meta-regression. Adults undergoing lumbar microdiskectomy due to degenerative disc herniation, excluding spinal stenosis, percutaneous diskectomy, artificial disk, arthroplasty, laminectomy, fusion or symptoms of cauda equina.

Results: Of identified 2,285 records, 31 were included in meta-analysis. Most of the studies had low risk of systematic bias. Pooling 21 studies, the mean prevalence of postoperative return to work was 78% (95% CI 71% to 83%). Pooling 13 studies the mean time of return to work was 4.79 (95% CI 3.88 to 5.70) weeks. The meta-regression of prevalence of return to work by the duration of follow-up resulted in significant but small coefficient of 0.02 (95% CI 0.01 to 0.03, P=0.006). There was considerable heterogeneity for all three models.

Conclusion: The results of this review suggest that approximately 70%-80% of patients who undergo a microsurgical procedure for disc herniation return to work within the first month and a half. It also seems that returning to work after this period is quite unlikely. The duration of preoperative symptoms did not affect significantly the prevalence of RTW. Information about these trends should be taken into account both in the planning phase of the procedure and in setting goals for postoperative rehabilitation.

Key Words: diskectomy, microsurgery, intervertebral disc degeneration, return to work

INTRODUCTION

Lumbar disc herniation is a common radiological finding and a common cause of pain and disability [1]. Its incidence is 2% – 3% and prevalence around 12% among people above 35 years of age [2]. The incidence of spinal surgical procedures has grown considerably over the past 30 – 40 years [3]. At the same time, extensive open surgeries have been replaced by microsurgical procedures, which meant less tissue damage and were expected to result in faster healing and a faster return to routine life, including an earlier return to work (RTW). Microdiscectomy, as a modification of standard discectomy assisted by microscope, was first described by Caspar et al. in 1977 [4]. For now, microsurgical discectomy is the most commonly performed procedure for disc bulging, usually when other serious conditions such as stenosis in the spinal canal or nerve root canals are not involved [2].

Ability to work rarely emerges as a primary outcome in studies on spinal surgery. Thus, RTW has often been left outside the scope of previous reviews on the effects of spinal surgery [5]. Based on 23 studies on microdiskectomy, a review by Rehman et al. has reported a correlation between failed RTW and negative outcome expectations, fear of movement, somatization, and poor coping skills [6]. Instead, age, the severity of degenerative changes, clinical examination findings, side and level of disc herniation were not associated with RTW. Another systematic review on microdiskectomy has reported on correlation between failed RTW and female sex [7]. Based on 63 studies, a systematic review on surgery due to lumbar radiculopathy has reported a very wide pooled estimated concerning RTW: the average duration of postoperative sick leave varied from one week to 20 weeks, while the prevalence of RTW ranged from 3% to 100% [8]. The same review also suggested that the speed of RTW correlated with the preoperative severity of pain and disability, the presence of depression, job-related stress, the lateral direction of disc protrusion, and less invasive surgical techniques. In 2024, Tang et al. has published a meta-analysis on RTW after spinal surgery [9]. Based on 10 studies, a recent meta-analysis on RTW after spinal surgery has estimated the prevalence of RTW to be around 60%. This estimate was affected by sex, age, job characteristics, fear of disease progression, and the lack of social support.

A large register-based analysis covering 12,435 patients undergoing spinal surgery has observed RTW of 85% [10]. Failed RTW was associated with older age, female sex, severe and prolonged preoperative pain, physically demanding occupation and compensation claim. In a nation-wide cohort of 26,688 patients undergoing spinal surgery the prevalence of RTW has varied between 25% and 80% depending on whether a participant preoperatively considered disability pension or not [11].

While previous knowledge has suggested that RTW after microdiskectomy might vary depending on some preoperative factors, there is no certainty about the magnitude of this variation or the speed of RTW after surgery. This information can be important when planning the procedure, informing the patient about the possible healing and rehabilitation process, and directing resources to postoperative rehabilitation. The objective of this meta-analysis was to investigate quantitative evidence on the prevalence and timeline of RTW after lumbar microdiskectomy.

MATERIALS AND METHODS

Inclusion and exclusion criteria (PICO)

- Patients – adults >= 18 years undergoing lumbar microdiskectomy due to herniated disc of any size. Excluded: other reasons for surgery (like cancer, congenital diseases, traumas, infections etc.) than degenerative changes in intervertebral disc. Spinal stenosis as a main indication for surgery was also excluded.
- Intervention – microdiskectomy was understood here as a surgical procedure to remove part of a disk in the lumbar spine using magnification devices. Procedures involved percutaneous diskectomy/nucleolysis, artificial disk, arthroplasty, laminectomy, fusion or symptoms of cauda equina were excluded. Also, procedures having primary goal to promote a particular device or medication were excluded.
- Comparison – not applicable
- Outcome – any estimates describing return to work after diskectomy including timeframes, prevalence, incidence, predictors, occupational status before and after etc.
- Data sources and search strategy. The search at Medline (via PubMed), Embase, Cinahl, Scopus, Web of Science and reference lists of relevant articles was conducted in September 2024. The search strategy is presented in Supplement 1.
- Types of publications – any study published in academic peer-review journals in any language with abstracts available excluding conference proceedings, theses, editorials, case reports and case series with n<10.

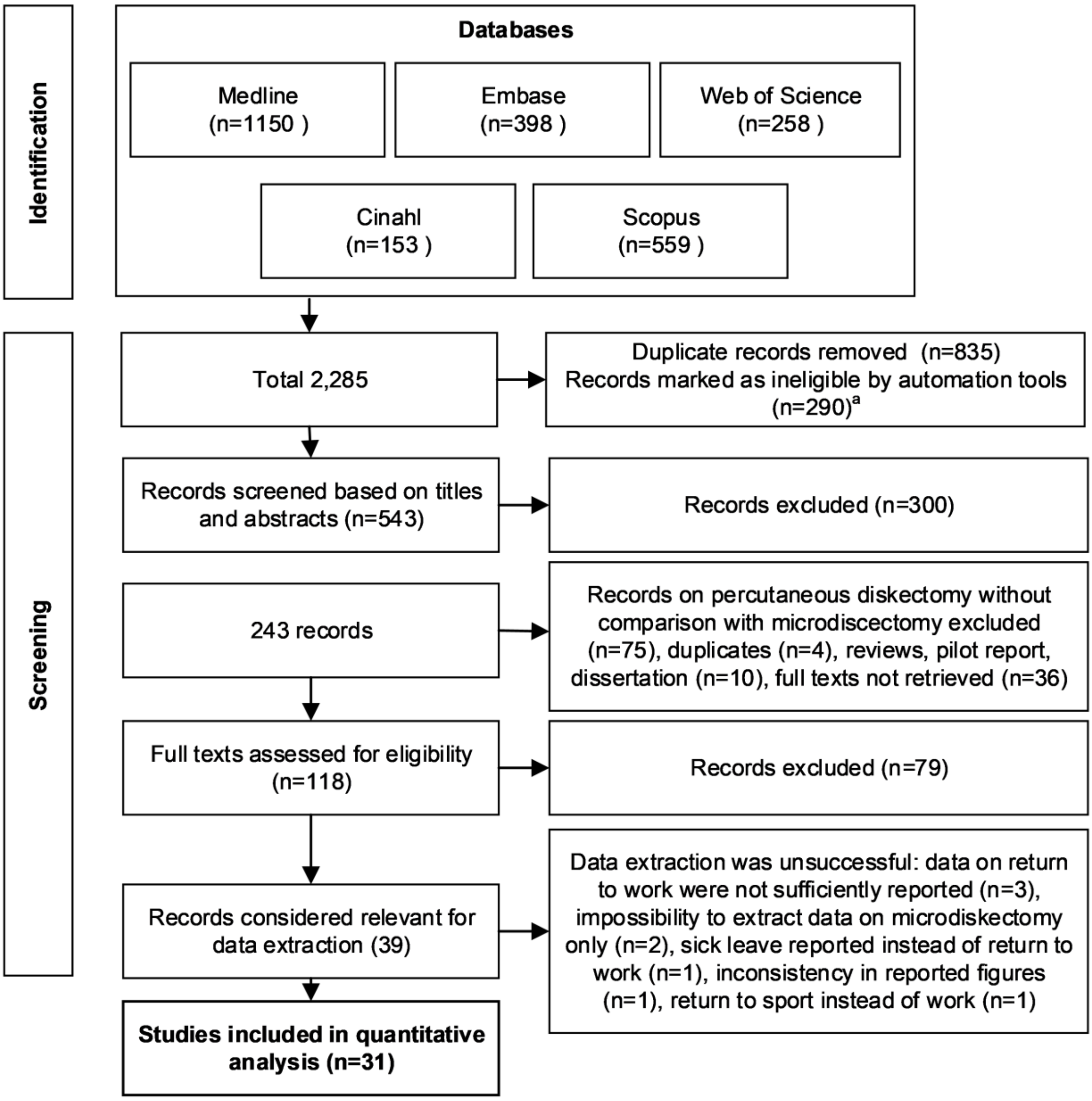
Registration

The review was registered on PROSPERO cite – CRD42024588903.

Selection strategy

The records identified from the data sources were stored in the Endnote software (Endnote X7.8, Thomson Reuters). Using a build-in search engine of the Endnote software, duplicates, conference proceedings, theses, reviews, case reports etc. were deleted. Two independent reviewer teams were formed: MS and EV vs. VM and JJ. These reviewer teams screened the titles and abstracts of the remaining records and assessed the full texts of potentially relevant papers (see PRISMA search flowchart in Figure 1). Disagreements between the reviewers were resolved by a consensus.

Figure 1 Search flow



[a] Using the search engine of Endnote® software, the records were filtered out by a single author using keywords appearing in titles or abstracts: conference; artificia; arthropla; device; pediatr; paediatr; pilot; tlif; abscess; inflam; spondyliti; disciti; achilles; acupuncture; adolesc; laminect; animal; case report; cell; oxygen; hand; ultrasound; cervical; child; promoting a specific drug or device; experiment; fracture; stenosis; cauda; guideline; infect; injection; injury; magneti; protocol; rat; retina; review; overview; robotic; mandibul; antibiot; candida; cathether; nucleolysis; laser; spondylo; arthrodes; sacroiliac; steroid; stimula; thoraci; trauma; whiplash. Also using the same Endnote® software, the records were filtered out if there were mentions of following terms: "work-related", but not in a sense of return to work or "fusion" but without mention of "disk" or "disc". At this stage, guidelines, reviews with or without meta-analyses, publications on the state-of-art situation and historical publications were also excluded.

Extraction strategy

Data were extracted using predefined checklist containing publication year, publication country, sample size, age and gender distributions, the length of follow-up, information concerning occupational and educational status, relevant outcomes.

Assessment of risk of systematic bias

The risk of systematic bias was assessed using the Quality in Prognosis Studies (QUIPS) tool including six domains: study participation, study attrition, prognostic factor measurement, outcome measurement, study confounding, and statistical analysis and reporting [12]. Each domain was rated as "high", "moderate", or "low" risk. The overall risk was defined as "high" or "low": "low" if the scores for all domains were "low" or only one was "moderate"; and "high" if there was "high" score for any domain
or there were two or more "moderate" scores.

Availability of full texts

Based on the results of the initial search, it became clear that the amount of published information will be large. Considering that this project had no external funding, it was decided that the full texts would not be acquired through paid services. Full texts were searched through the university's extensive subscription, online search and by contacting the authors of the articles through the Research Gate service. Most of the missing full texts were older articles from the 1990s and articles in a language other than English. In this situation, the research team considered an alternative to use time of publication and language limits. However, in order to maintain the coverage of the review, it was decided to continue without the limits in question. Certainly, this solution meant that the review is not exhaustive, and the results of the meta-analysis better describe existing trends than the exact phenomena covering the entire body of literature.

Statistical analysis (meta-analysis)

When only range had been reported, a mean was approximated as 'mean ≈ (max + min)/2'. When variance had been reported as a range, an interquartile range (IQR), or as a 95% confidence interval (95% CI) a standard deviation (SD) was calculated as: 'SD ≈ IQR/1.35', 'SD ≈ range/4', or SD= √n*(upper 95% limit – lower 95% limit)/3.92. When variance was not reported, a SD was imputed from a study with similar mean estimate [13 14]. The strength of correlation was interpreted as follows: 0.90 to 1.00 'very high'; 0.70 to 0.90 'high'; 0.50 to 0.70 'moderate'; 0.30 to 0.50 'low'; and 0.00 to 0.30 'negligible' [15]. Kappa of agreement was calculated for the first selection round based on abstracts and titles. The Cohen's kappa was interpreted as follows: values ≤ 0 'no agreement'; 0.01–0.20 'none to slight'; 0.21–0.40 'fair'; 0.41– 0.60 'moderate'; 0.61–0.80 'substantial'; and 0.81–1.00 'almost perfect agreement' [16].

A random-effects model was used assuming the presence of substantial heterogeneity across the identified studies. The studies in the analysis were assumed to be a random sample from a universe of potential studies, and this analysis will be used to make an inference to that universe. Pooled estimates were accompanied by 95% CIs and two-tailed p-value, when appropriate. When conducting the analysis of publication bias, a one-tailed p-value was reported. The level of significance was set at <0.05. The test for heterogeneity was conducted using the Q test considering heterogeneity being present if Q was greater than the degree of freedom (number of studies – 1). The I^2 statistic described the percentage of the variability in effect estimates that was due to heterogeneity rather than sampling error (chance). A potential publication bias was evaluated graphically by using a funnel plot and by the Egger's test for asymmetry of the funnel plot (test for the Y intercept = 0 from the linear regression of normalized effect estimate against precision). The trim-and-fill method was used to impute studies into funnel plot to correct asymmetry if needed. A publication bias was assessed when the number of studies in the model was >=10. Along with 95% CIs, prediction intervals (PIs) were calculated as: 95% PI = pooled estimate + 1.96 x Tau. While confidence interval defines the average effect expected to be seen, prediction interval defines the boundaries of true effect expected to be seen for a single new observation (e.g., next patient).

Metaregression was conducted using random effects, Z-distribution and logit event rate on a) the duration of follow-up and b) the duration of preoperative symptoms. The results of Metaregression were reported graphically and numerically as Q-statistics, degrees of freedom (df), p-value, coefficient of determination (R^2) and heterogeneity statistics (Tau, Tau^2 and I^2). For convenience, the results (logit units) were restored and presented in their original form.

All calculations were performed using the Comprehensive Meta-Analysis, Version 4, Borenstein, M., Hedges, L., Higgins, J., & Rothstein, H., Biostat®, Englewood, NJ 2022.

RESULTS

Through the search, 2,285 records were identified (Figure 1). Of them, 543 were screened based on their titles and abstracts (kappa of agreement 0.60 [95% CI 0.50 to 0.69] for MS vs EV and 0.52 [95% CI 0.43 to 0.62] for JJ vs. VM) and 118 were screened based on their full texts. In total, 39 records were considered relevant for data extraction. Data were successfully extracted from 31 publications (Table 1). Of them, 14 were prospective studies of different designs, 14 were retrospective, the design of three studies was undetermined. The studies have been published between 1990 and 2024. The periods of follow-ups varied from one month to 7.5 years. The sample sizes varied widely from 21 up to 955, 3,778 persons were overall involved. The mean age varied from 22 up to 55 years. Most of the samples were slightly predominated by men. Most of the studies had low risk of systematic bias (Table 2).

Table 1. Descriptive characteristics of included studies

Author, year, country	Follow-up, monts	N	Age, years (mean and SD/range)	Women, %	Design	Preoperative occupational status, % of employed or studying
Adam et al. 2013, Romania[18]	1,3,6 and 12	80	47 (20-79)	48	unclear	80%
Ahn et al. 2016, South Korea[19]	unclear	34	22.2 (1.5)	0	retrospective	Not reported
Ahn et al. 2019, South Korea[20]	unclear	152	35.4 (14-77)	38	retrospective	Not reported
Almeida et al. 2007, Brazil[21]	62.4	350	43.1 (14.77)	52	retrospective	82%
Asch et al. 2002, USA[22]	1.5, 6 and 12	212	41 (11.3)	14	prospective	Not reported
Barrios et al. 1990, Sweden[23]	unclear	75	40.9 (12.0)	25	retrospective	Not reported
Bhatia et al. 2016, India[24]	unclear	46	41.7 /11)	37	retrospective	Not reported
Brennan et al. 2017, UK[25]	3 and 12	107	42.7 (19-70)	47	prospective	61%
Carragee et al. 2006, USA[26]	12 and 24	46	37.5 (22-57)	46	prospective	89%
Caspar et al. 1991, Israel[27]	33.6	299	44 (17-71)	38	retrospective	Not reported
Demir et al. 2014, Turkey[28]	26	44	41.1 (8.93)	45	prospective	73%
Gulati 2004, India[13]	30	151	45 (23-62)	36	unclear	Not reported

Hodges et al. 2001, USA[29]	unclear	36	43.1 (23-68)	34	retrospective	47% (entire sample)
Hussein 2016, Egypt[30]	25.5	37	30.5	46	prospective	Not reported
Jaiswal et al. 2019, India[31]	12	58	37.8 (9.6)	33	prospective	Not reported
Jarebi et al. 2021, Saudi Arabia[32]	24	29	47 (12.6)	48	retrospective	90% (50% manual)
Jensdottir et al. 2007, Iceland[33]	90	134	37 (17-58)	42	retrospective	95%
Kafchitsas et al. 2014, Germany[34]	24	55	55 (26-72)	47	unclear	100%
Kang et al. 2020, South Korea[35]	2.3	67	42.0 (8.02)	16	prospective	100%
Kasir et al. 2023, USA[36]	3,12 and 24	955	51.0 (18-91)	47	retrospective	47%
Klukowska et al. 2024, Netherlands[37]	12	103	53.2 (14.4)	49	prospective	64%
Kohlboeck et al. 2004, Germany[38]	6	58	47 (11.7)	40	prospective	Not reported
Laos-Plasier et al. 2022, Peru[39]	3	68	40.2 (8.5)	32	retrospective	90%
Martínez Quiñones et al. 2011, Spain[40]	60	142	39.3	18	retrospective	100%
Newsome et al. 2009, UK[41]	3	30	37.5	33	prospective	80%
Nygaard et al. 2000, Norway[42]	12	132	unclear	unclear	prospective	Not reported
Righesso et al. 2007, Brazil[14]	24	21	42.0 (10.7)	52	prospective	Not reported
Shahi et al. 2023, USA[43]	24	115	45.2	35	retrospective	Not reported [a]
Song et al. 2021, South Korea[44]	12	29	41.38 (10.92)	48	retrospective	100% [b]
Türeyen 2003, Turkey[45]	1 and 12	63	42.3 (18-59)	43	prospective	83%
Veresciagina et al. 2010, Lithuania[17]	24	50	43.0 (21-76)	47	prospective	Not reported

[a] Probably 100% as any worker's compensation was used as exclusion criteria; [b] Occupational grade was reported for all 29 participants;

Table 2. Risk of systematic bias of the included studies.

Author, year	Domains						Total risk
	1	2	3	4	5	6	
Adam et al. 2013, Romania[18]	low	low	low	low	moderate	low	low
Ahn et al. 2016, South Korea[19]	low	moderate	low	low	low	low	low
Ahn et al. 2019, South Korea[20]	low	low	low	low	low	low	low

Almeida et al. 2007, Brazil[21]	low	low	low	low	low	moderate	low
Asch et al. 2002, USA[22]	low	low	low	low	moderate	low	low
Barrios et al. 1990, Sweden[23]	high	low	low	low	moderate	low	high
Bhatia et al. 2016, India[24]	low	low	low	low	moderate	low	low
Brennan et al. 2017, UK[25]	low	low	low	low	low	low	low
Carragee et al. 2006, USA[26]	low	moderate	low	low	low	low	low
Caspar et al. 1991, Israel[27]	low	low	low	low	moderate	low	low
Demir et al. 2014, Turkey[28]	low	low	low	low	low	low	low
Gulati 2004, India[13]	low	low	low	low	moderate	low	low
Hodges et al. 2001, USA[29]	low	low	low	moderate	low	low	low
Hussein 2016, Egypt[30]	low	low	low	low	low	low	low
Jaiswal et al. 2019, India[31]	low	moderate	low	moderate	low	low	high
Jarebi et al. 2021, Saudi Arabia[32]	low	low	low	low	low	low	low
Jensdottir et al. 2007, Iceland[33]	low	low	low	low	low	low	low
Kafchitsas et al. 2014, Germany[34]	moderate	moderate	low	moderate	moderate	moderate	high
Kang et al. 2020, South Korea[35]	low	low	low	low	low	low	low
Kasir et al. 2023, USA[36]	low	low	low	low	low	low	low
Klukowska et al. 2024, Netherlands[37]	low	low	low	low	low	low	low
Kohlboeck et al. 2004, Germany[38]	low	low	low	low	low	low	low
Laos-Plasier et al. 2022, Peru[39]	low	low	low	low	low	low	low
Martínez Quiñones et al. 2011, Spain[40]	low	low	low	low	low	low	low
Newsome et al. 2009, UK[41]	low	low	low	low	low	low	low
Nygaard et al. 2000, Norway[42]	low	low	low	low	moderate	low	low
Righesso et al. 2007, Brazil[14]	low	low	low	low	low	low	low
Shahi et al. 2023, USA[43]	low	low	low	low	low	low	low
Song et al. 2021, South Korea[44]	low	low	low	low	low	low	low
Türeyen 2003, Turkey[45]	moderate	low	low	low	low	low	low
Veresciagina et al. 2010, Lithuania[17]	low	low	low	low	low	low	low

1 – Study Participation; 2 – Study Attrition; 3 – Prognostic Factor Measurement; 4 – Outcome Measurement; 5 – Study Confounding; 6 – Statistical Analysis and Reporting

Preoperative employment

Preoperative employment has been reported in around the half of the included studies (Table 1). The reported estimates were inconsistent. Some reports were unclear as to whether they were referring specifically to the situation just before surgery or some time before, for example, the time of onset of symptoms. Some reports distinguished preoperative work situations into special categories such as “housewife” or “house-based employment”. Only a few reports specifically classified full-time studying as work. A few articles reported, usually inconsistently, the degree of physical strain of the work. This often meant that extracted information had to be based indirectly on the full text of the article.

Meta-analysis

When pooling the results of 21 studies, the mean rate of RTW was 78% (95% CI 71% to 83%). There was a substantial heterogeneity (I^2=92%) (Figure 2). There was no evidence of publication bias (Egger's test p=0.75) (Figure 3). In turn, based on 13 studies, the pooled time of RTW after surgery was 4.79 (95% CI 3.88 to 5.70) weeks (Figure 4). There was a substantial heterogeneity (I^2=99%). While the Egger’s test showed statistically significant risk of publication bias (p= 0.002), no trim-and-fill correction was required (Figure 5).

Figure 2 Prevalence of return to work. 1.0 corresponds to 100% of a successful return to work after surgery. The longest available periods of follow-ups are used.

Study name	Event rate	Lower limit	Upper limit	Relative weight
	Statistics for each study			
Adam et al. 2013	0.31	0.22	0.42	5
Kohlboeck et al. 2004	0.48	0.36	0.61	5
Veresciagina et al. 2010	0.60	0.46	0.73	5
Asch et al. 2002	0.61	0.54	0.67	5
Barrios et al. 1990	0.61	0.50	0.72	5
Brennan et al. 2017	0.66	0.57	0.75	5
Laos-Plasier et al. 2022	0.69	0.57	0.79	5
Hodges et al. 2001	0.72	0.56	0.84	4
Jaiswal et al. 2019	0.79	0.67	0.88	5
Almeida et al. 2007	0.80	0.75	0.84	5
Newsome et al. 2009	0.80	0.62	0.91	4
Jensdottir et al. 2007	0.81	0.73	0.86	5
Nygaard et al. 2000	0.82	0.74	0.88	5
Türeyen 2003	0.83	0.71	0.90	5
Martínez Quiñones et al. 2011	0.83	0.76	0.88	5
Kasir et al. 2023	0.85	0.83	0.87	5
Carragee et al. 2006	0.87	0.74	0.94	4
Shahi et al. 2023	0.88	0.80	0.93	5
Kang et al. 2020	0.91	0.81	0.96	4
Klukowska et al. 2024	0.92	0.85	0.96	4
Caspar et al. 1991	0.95	0.92	0.97	5
Pooled	0.78	0.71	0.83	
Prediction Interval	0.78	0.40	0.95	

$Tau^2=0.59$; $Tau=0.77$; $Q=263.1$; $df=20$; $I^2=92\%$

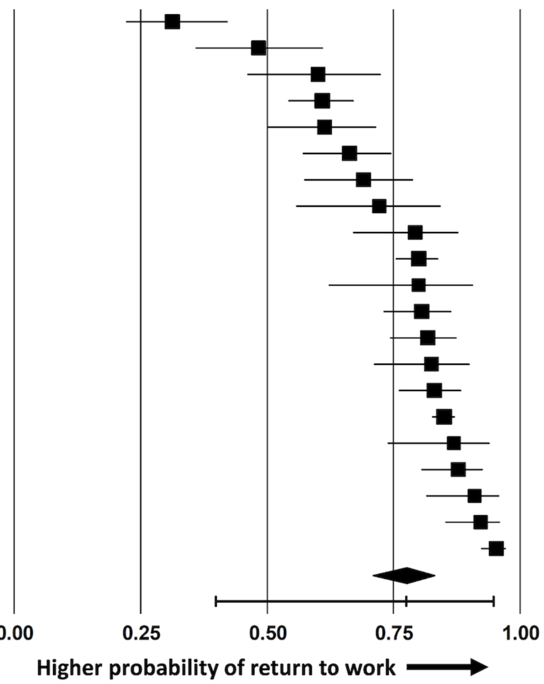


Figure 3 Funnel plot of potential publication bias in meta-synthesis of prevalence of return to work.

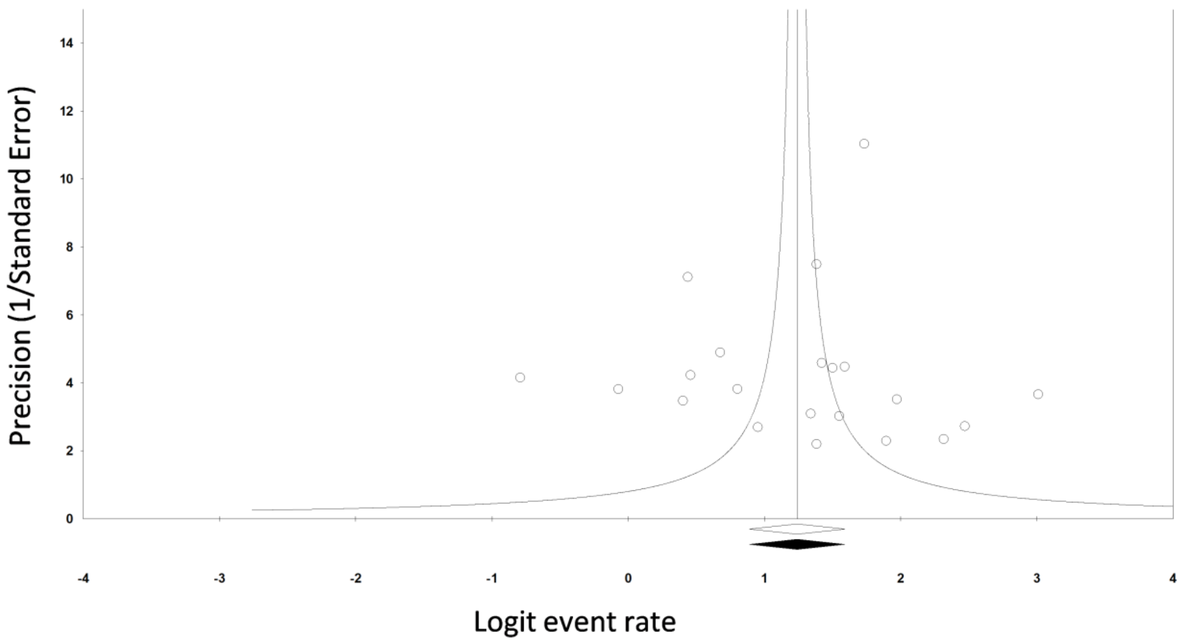


Figure 4 Time of return to work in weeks. The longest available periods of follow-ups are used.

Study name	Mean	Lower limit	Upper limit	Total	Relative weight
Hussein 2016	1.3	1.2	1.5	37	8
Shahi et al. 2023	1.6	1.5	1.7	115	8
Gulati 2004	3.0	2.8	3.2	151	8
Righesso et al. 2007	3.0	2.4	3.6	21	8
Song et al. 2021	3.5	2.9	4.1	29	8
Kafchitsas et al. 2014	4.0	3.8	4.2	55	8
Ahn et al. 2016	4.2	3.9	4.5	34	8
Kang et al. 2020	5.1	3.7	6.5	67	7
Demir et al. 2014	5.4	4.4	6.3	44	7
Jarebi et al. 2021	6.6	5.7	7.5	29	8
Bhatia et al. 2016	7.0	5.9	8.0	46	7
Barrios et al. 1990	8.5	7.2	9.9	75	7
Ahn et al. 2019	10.4	9.6	11.2	152	8
Pooled	4.8	3.9	5.7		
Prediction Interval	4.8	1.1	8.5		

Statistics for each study

$Tau^2=2.64$; $Tau=1.63$; $Q=1456.43$; $df=12$; $I^2=99\%$

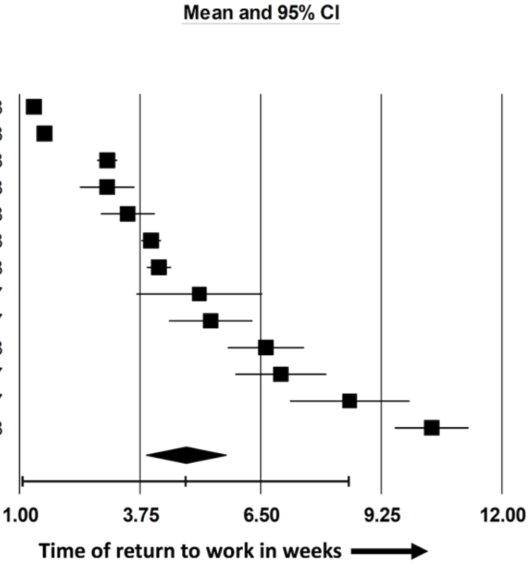


Figure 5 Funnel plot of potential publication bias in meta-synthesis of the time of return to work.

Meta-regression

The regression coefficient for the frequency of RTW by the duration of follow-up was significant but small – each additional week increases the average rate of RTW by 1.02 (95% CI 1.01 to 1.03) (Figure 6 and Supplement 2). The regression coefficient for the frequency of RTW by the duration of preoperative symptoms was insignificant – each additional week decreases the average rate of RTW by 0.98 (95% CI 0.84 to 1.14) (Figure 7).

Figure 6 Prevalence of return to work by the duration of follow-up—meta-regression. Intercept 0.54 (SE 0.2, 95% CI 0.16–0.93, Z -value 2.76, P =0.0058; Slope 0.02 (SE 0.01, 95% CI 0.01–0.03, Z -value 2.78, P =0.0055; Simultaneous test that all coefficients (excluding intercept) are zero: Q = 7.71, df = 1, P = 0.0055; Goodness of fit (test that unexplained variance is zero): Tau^2 = 0.58, Tau = 0.76, I^2 = 94.54%, Q = 494.37, df = 27, P = 0.0000; Comparison of the analyzed model with the null model: total between-study variance (intercept only) Tau^2 = 0.64, Tau = 0.80, I^2 = 95%, Q = 572.09, df = 28, P = 0.0000; Proportion of total between-study variance explained by the model: R^2 analog = 0.08

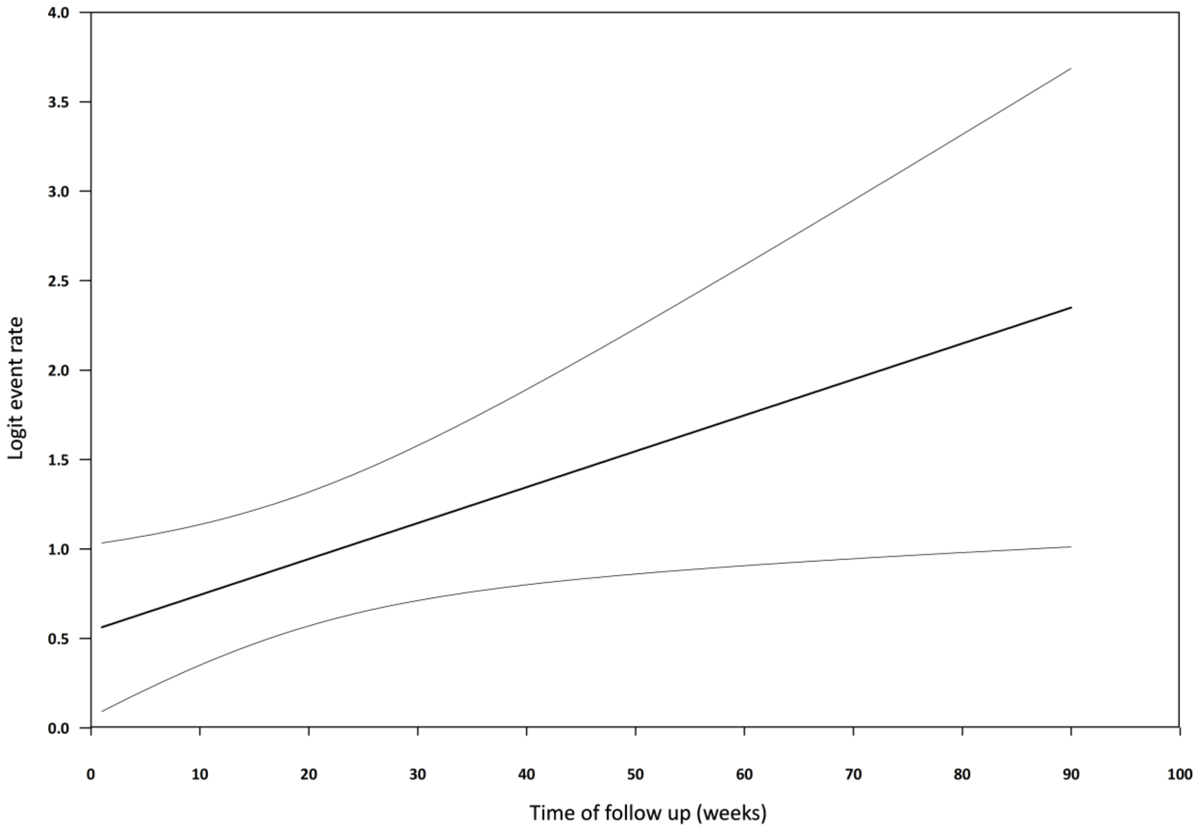
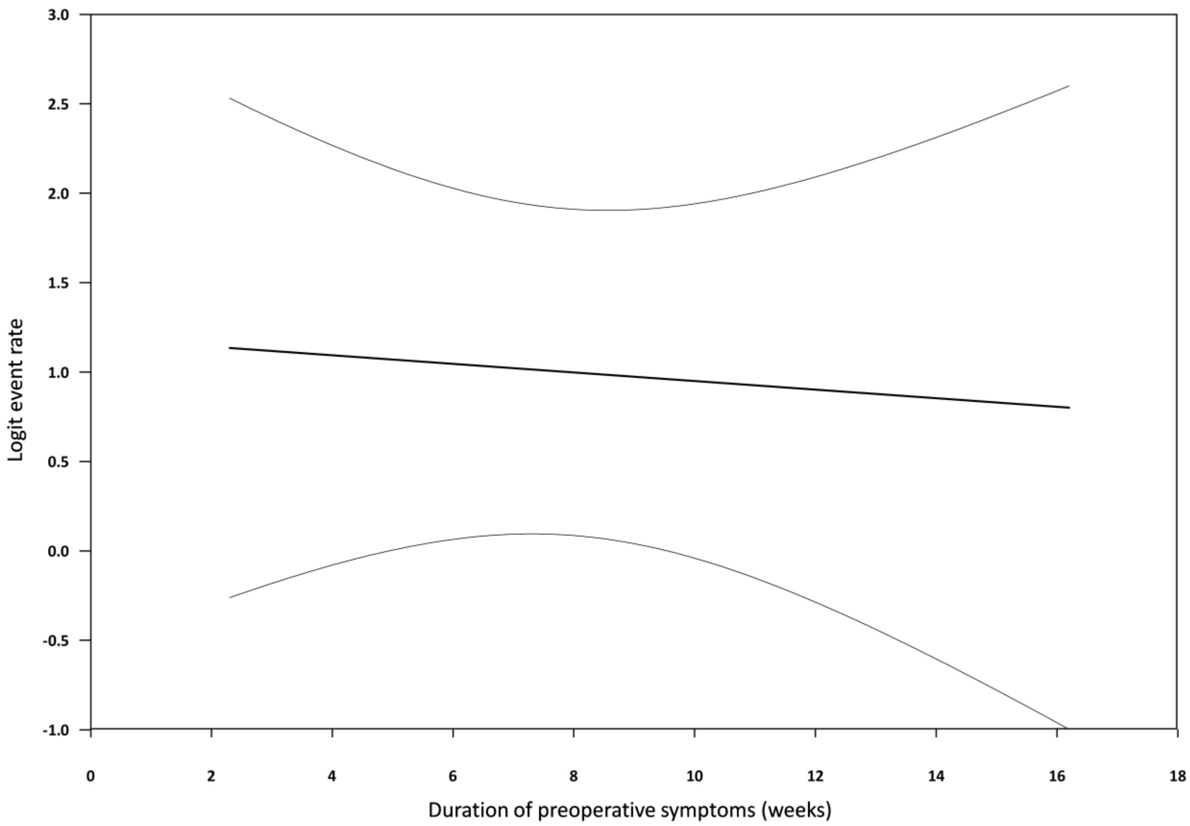


Figure 7 Prevalence of return to work by the duration of preoperative symptoms – meta-regression. Intercept 1.19 (SE 0.71, 95% CI −0.21 to 2.59, Z -value 1.67, P =0.0953; Slope −0.02 (SE 0.08, 95% CI −0.17 to 0.13, Z -value −0.31, P =0.7542; Simultaneous test that all coefficients (excluding intercept) are zero: Q = 0.10, df = 1, P = 0.7542; Goodness of fit (test that unexplained variance is zero): Tau^2 = 0.85, Tau = 0.92, I^2 = 91%, Q = 57.13, df = 5, P = 0.0000; Comparison of the analyzed model with the null model: total between-study variance (intercept only) Tau^2 = 0.72, Tau = 0.85, I^2 = 90%, Q = 57.64, df = 6, P = 0.0000; Proportion of total between-study variance explained by the model: R^2 analog = 0.00.



Effect of age

As a sensitivity test, the frequency of RTW was regressed on the age as reported by the included studies. The regression coefficient for the frequency of RTW by the age of the participants was insignificant – each additional year increases the average rate of RTW by 1.02 (95% CI 0.93 to to 1.11). Also, the speed of RTW was regressed on the age as reported by the included studies. The regression coefficient for the speed of RTW by the age of the participants was insignificant – each additional year decreases the speed of RTW by 0.99 (95% CI 0.87 to 1.14).

DISCUSSION

This meta-analysis focused on the prevalence and speed of return to work after lumbar diskectomy. Based on 21 studies, the average return to work after lumbar microdiskectomy was 78%. Based on 13 studies, the mean time of return to work after surgery was around one month. The metaregression coefficient was small, showing that most of the patients have either returned to work quite soon after the surgery or have not returned at all. Interestingly, it seemed that the duration of preoperative symptoms did not affect the prevalence of RTW. There was significant heterogeneity between studies. There was some evidence of publication bias, which however hardly affected the overall results.

Probably the most surprising finding was how consistent the prevalence figures were, taking into account differences in study designs, age ranges, surgical techniques, geographic locations, and insurance systems. The studies included in the analysis often used very different methods of postoperative rehabilitation (some of the studies were, in fact, RCTs comparing different rehabilitation methods). The microsurgical techniques as well as the location and number of operated intervertebral spaces also varied. Despite all this, based on the lower bounds of the pooled confidence intervals, it can be expected that at least 70% of the operated patients are likely to return to work and this return mostly occurs at the end of the first or during the second postoperative month. Considering the relatively young age of most of the included studies, 70% or even an average of 78% seem quite low.

This research team have expected much more patients to return to work after surgery. Certainly, one reason for that could be too ambiguous definitions of RTW in different studies. Another possible reason could be the fact that not all the studies have described in detail the preoperative employment situations of the patients. The reports on this matter were mostly inconsistent, while being missing for the half of the studies. However, this inconsistency could hardly affect the pooled timeline of RTW. Also, its effect on the pooled results concerning the prevalence of RTW was probably small, as it could be assumed that most of the studies reported RTW frequencies for the participants who have been employed before surgery. Additionally, most of the studies have been conducted amongst population of people of working age, usually between 40 and 50 years. Thus, it could be assumed that most of the participants had been employed before surgery. The restrictions recommended by surgeons have not been reported in the included studies. Such restrictions might play a significant role especially concerning the schedule of RTW.

The schedule for returning to work also seems a little unexpected in this study – it could have been assumed that a large part of the patients who were unable to return to their workplace immediately after surgery, will return later. Also, considering possible recommendations of physical restrictions given by a surgeon and postoperative sick-leaves it could be expected that the timeline of RTW might be a little longer than one month. However, after one month, RTW was seen for only a small number of respondents and the regression curve was close to a horizontal line. Aforementioned recommendations and sick-leaves might certainly explain the fact that the most frequent RTW was seen around the end of the first postoperative month and not earlier.

The results of this meta-analysis can be compared with previously reported results of reviews on the topic only with reservation. No previous review has focused specifically on this surgical technique combined with this specific outcome measure. However, to some extent the results of this study can be mirrored in some previous reviews, which evaluated the return to work after other various spinal surgical procedures. The prevalence of RTW observed in the present study is similar to one reported by Khan et al. and Hammer et al. in their exceptionally large cohort studies[10 11]. Instead, the prevalence of RTW observed here was higher than 58% reported by a previous meta-analysis by Tang et al [9]. The figures reported by Huysmans et al. in their systematic review have been too wide-ranged to be compared with the present results – in that study RTW rate was estimated to be between 3% and 100% [8]. The differences between the present and previous findings may probably be explained by the fact that this meta-analysis was focused on a single spinal surgical technique – lumbar microdiskectomy, while earlier reviews have included all approached used in spinal surgery. The exception was a review by Rehman et al., which, however, did not contain information on the prevalence or timeline of RTW [6]. Regression analysis of RTW on the time since lumbar microdiskectomy has not been employed by any original research or by meta-synthesis.

The authors of this study emphasize that it was not an exhaustive review. Here, we tried to find out the general trends of the problem, and it is better to understand the results more as trends than as a certain situation in the population of interest. Besides that, meta-analysis is always an approximation and not exact absolute knowledge. However, due to the systematic nature of the review and the large number of included studies, it can be assumed that the actual situation in the population of interest should not be very far from the obtained results. The heterogeneity of the included studies was large, and according to the calculations, most of it was due to the variation of the true effect. The generalizability of the results can also be affected by a large variation in the definitions of the concept of return to work. In studies, returning to work may have meant returning to full-time work, part-time work, studying or just driving a car. In some studies, the work situation was fragmented and it could mean housewife tasks, home-based studying, etc. The meta-regression of prevalence of return to work by the duration of preoperative pain was conducted on the studies reporting the duration as a continuous variable. Unfortunately, due to software limitations, the variance of this duration could not be fed to the model. Thus, the meta-regression was calculated based on the mean estimates only regardless of the variance, which was substantial for almost all seven included in the analysis studies. It can be assumed that younger patients are more tend to return to work after surgery than older ones. However, no such assumption was confirmed by a sensitivity test.

Suggestions for further research

Many factors have been suggested as predictors of failed RTW after spinal surgery. There has been some evidence on a correlation between failed RTW and female sex, older age, preoperative severity of pain and disability, physically demanding occupation, compensation claim, fear of disease progression, presence of depression, job-related stress, lack of social support, lateral direction of disc protrusion, negative outcome expectations, fear of movement, somatization, and poor coping skills [6-9]. However, the role of these factors has been considered in relation to spinal surgery as a whole. This review was unable to identify any previous research on such predictors in regards to microdiskectomy only. There is a clear gap in knowledge, which could be clinically even more important than research on the prevalence or speed of RTW. Indeed, in this review, the important question remained unanswered – what preoperative factors unite those patients who were unable to return to work after surgery and how clearly do they separate these patients from the majority, who have been at work already one to two months after surgery? In addition, it is not known which factors slow down the return to work after lumbar microdiskectomy. Considering the possible directions of further research, the one that probably needs the most attention would be to find out which factors increase or decrease the risk of being excluded from working life after back surgery. Although microdiskectomy is the most common surgical method in the treatment of protruded intervertebral disc, many other techniques are also used. For example, during the review, it was seen that there are many publications about transcutaneous/endoscopic discectomy, in which return to work is also mentioned. The effects of these techniques on the occupational situation after surgery need to be clarified. The influence of chosen surgical technique on healing process and RTW may be important, but it is probably even more interesting has the problem of those who do not return to work resolved by surgery? It is possible that RTW does not occur even if pain and functioning have been improved. The role of complication in RTW after diskectomy also needs to be clarified. Additionally, it could be speculated that in some cases, the cause of main symptoms and disability has not been a herniated disc, but some other factors that remained unknown preoperatively. It is somewhat known that certain types of disc herniations heal better with surgery than others – how this could affect the rate and speed of RTW?

Conclusions

The results of this review suggest that approximately 70%-80% of patients who undergo a microsurgical procedure for disc herniation return to work within the first month and a half. It also seems that returning to work after this period is quite unlikely. The duration of preoperative symptoms did not affect significantly the prevalence of RTW in this meta-analysis. Information about these trends should be taken into account both in the planning phase of the procedure and in setting goals for postoperative rehabilitation.

KEY POINTS

- Approximately 70%-80% of patients who undergo a microsurgical procedure for disc herniation return to work within the first 1-2 months.
- Returning to work after this period is quite unlikely.
- Information about these trends should be taken into account both in the planning phase of the procedure and in setting goals for postoperative rehabilitation.
- The duration of preoperative symptoms did not affect significantly the prevalence of RTW.

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