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# Effectiveness of virtual reality in patients with neck pain: systematic review and meta-analysis

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## Aim

(1) To summarize the evidence from randomized controlled trials (RCTs) and controlled trials (CTs) that examined the effectiveness of active VR used in the treatment of patients with NP, (2) To determine the clinical effectiveness and the magnitude of the effect of active VR in the management of NP.

## Methods

**Design:** Systematic review with meta-analysis.

**Searches:** Medline (Ovid), Embase (Ovid), CINAHL (EBSCOhost), Cochrane Library Trials, Web of Science, and Scopus.

**Inclusion Criteria:** RCTs and CT with adults (>18 years old) with NP, that evaluated the effectiveness of active VR or augmented VR. VR could be implemented by using off-the-shelf or custom-made devices in combination with a display, allowing a multisensory experience and active interaction with the virtual world.

**Risk of Bias (RoB):** Revised Cochrane of Risk of Bias (RoB-2).

**Overall quality/certainty of evidence:** GRADE system.

**Outcomes Meta-analyses:** Pain, Neck disability, neck range of motion, quality of life and neck performance.

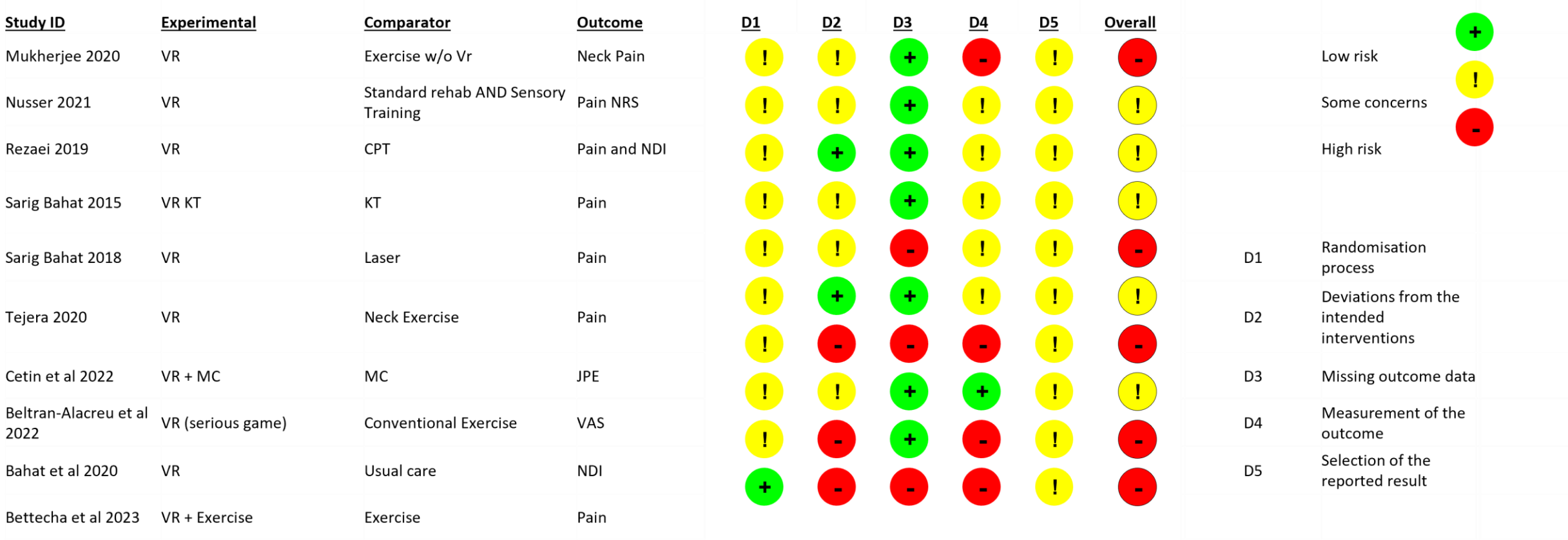
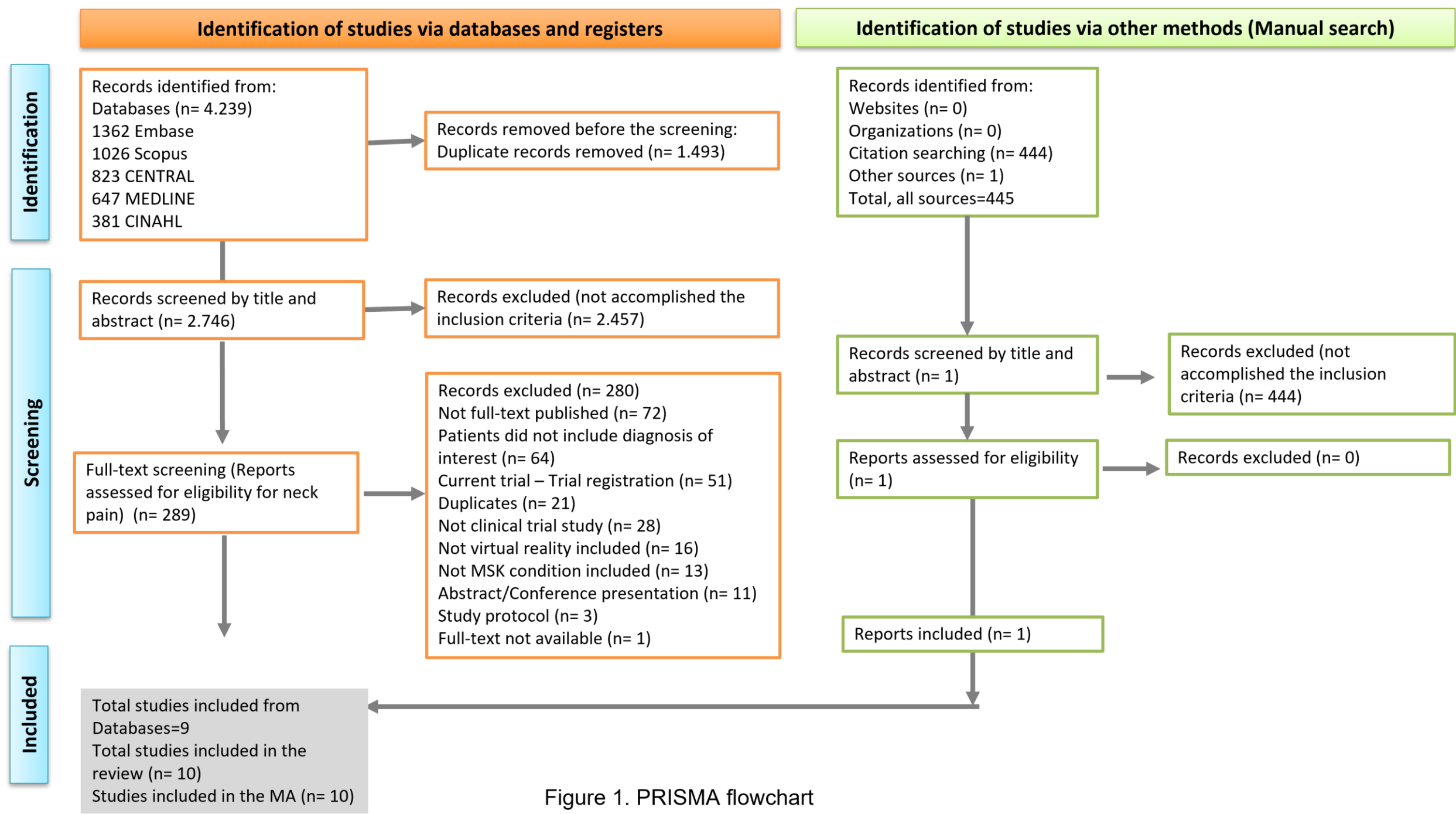


Figure 2. Risk of bias assessment

Virtual reality vs Exercise				Virtual reality vs Control	
Outcomes	End of treatment	One-month follow-up	Three-months follow-up	End of treatment	Six-months follow-up
Pain intensity	✓	✓	✗	✗	✓
Neck disability	✓	✗	✗	✗	✗
Flexion neck movement	✗	?	✗	?	?
Extension neck movement	✗	?	✗	?	?
Lateral flexion neck movement	✗	?	?	?	?
Rotation neck movement	✗	?	✓	?	?
Flexion - JPSE	✓	?	?	?	?
Extension - JPSE	✓	?	?	?	?
Lateral flexion - JPSE	✗	?	?	?	?
Rotation - JPSE	✓	?	?	?	?
Flexors strength	✗	?	?	?	?
Extensors strength	✗	?	?	?	?
Endurance	✗	?	?	?	?
Quality of life	✗	?	?	✗	✗
PPT: Trapezius	✗	?	?	?	?
PPT: C1-C2	✗	?	?	?	?
PPT: C5 – C6	✓	?	?	?	?
PPT: Tibialis	✗	?	?	?	?
Kinesiophobia	✗	✗	✓	?	?
Balance	✗	✗	✗	?	?

Figure 6. Summary of the results

## Results

## Meta-analysis

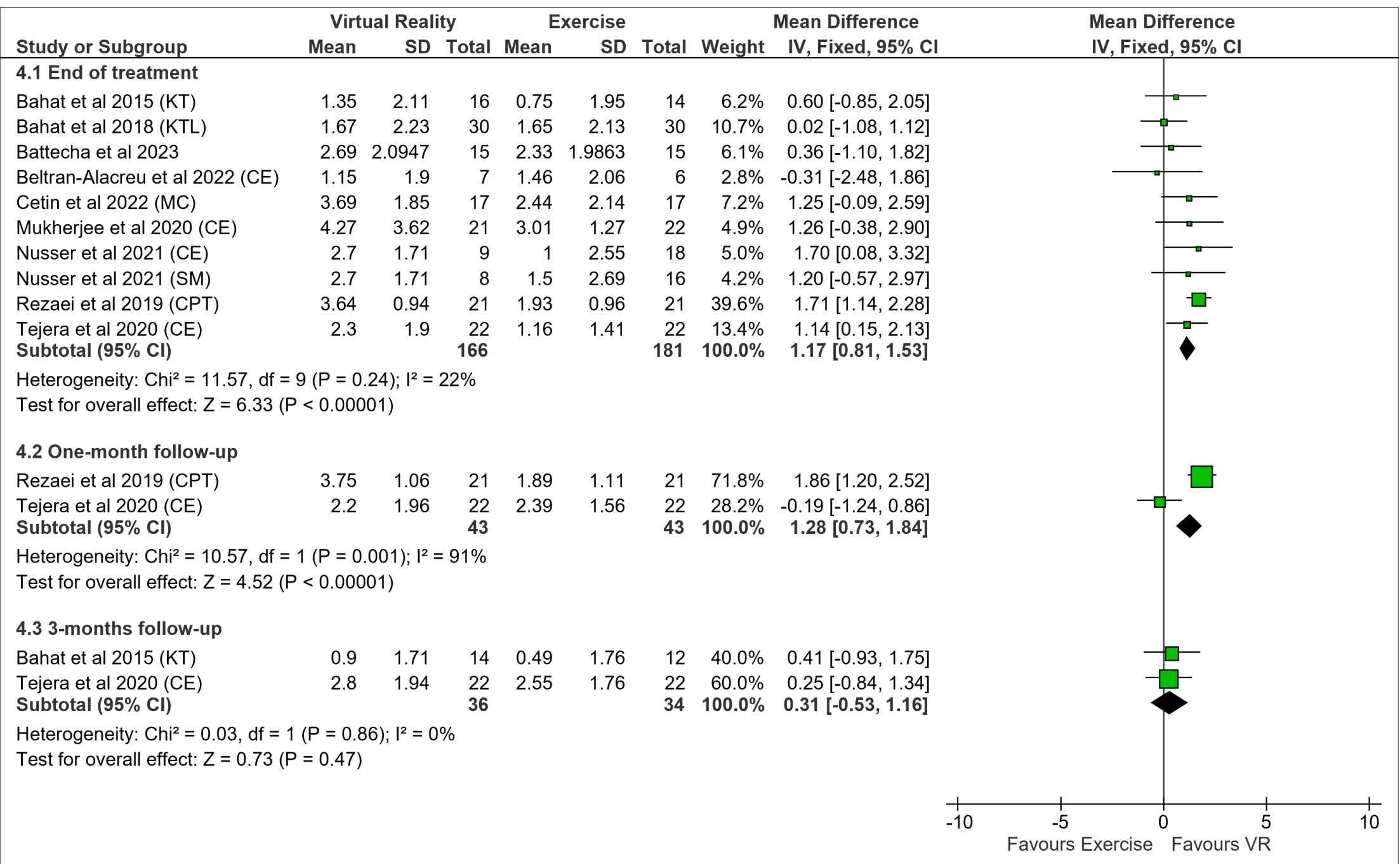


Figure 3. Comparison of virtual reality versus exercises on pain intensity at end of treatment, one-month follow-up, and 3-months follow-up. The results are presented as mean differences between before and after treatment.

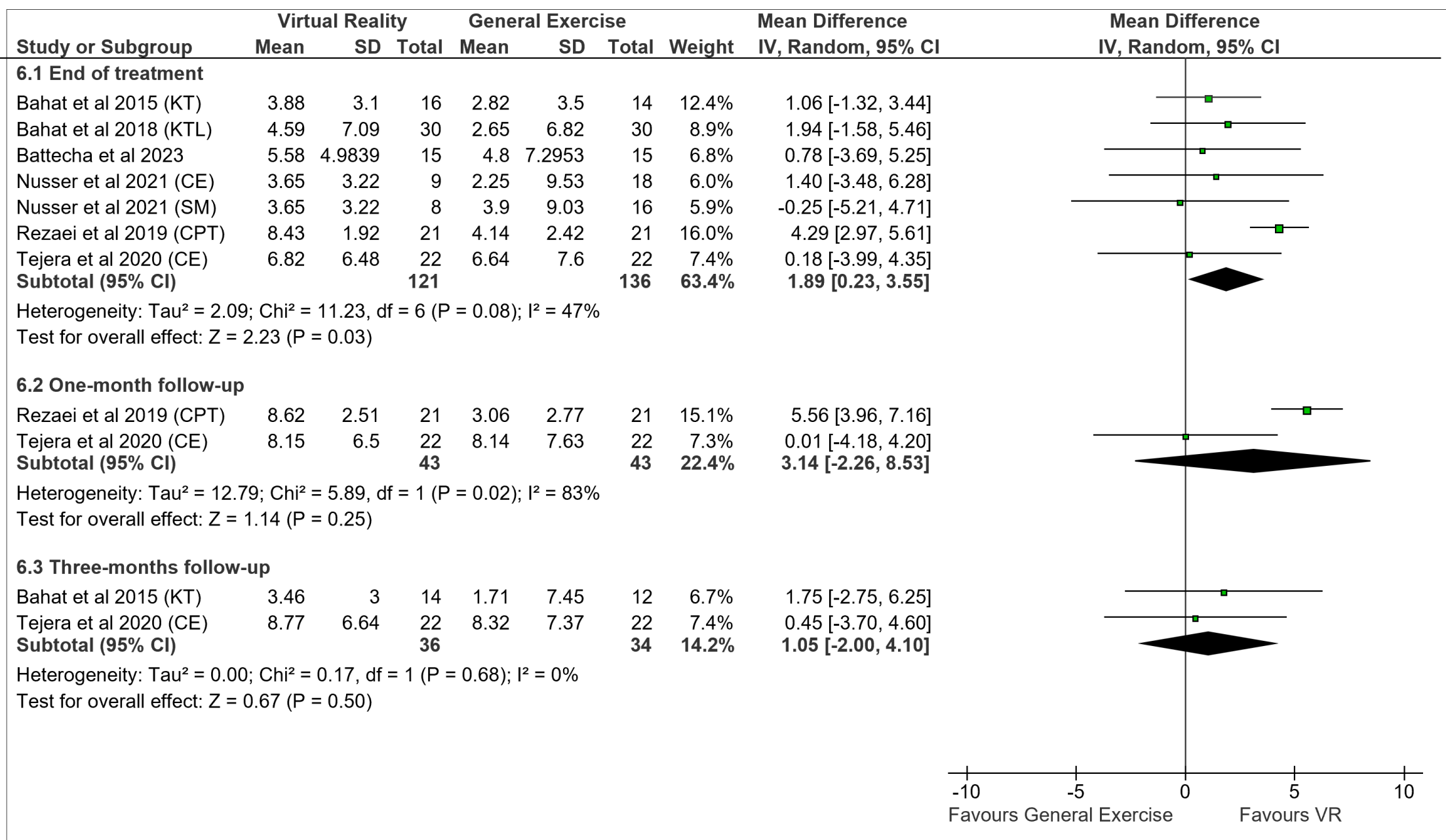


Figure 4. Comparison of virtual reality versus exercises on neck disability index at end of treatment, one-month follow-up, and 3-months follow-up. The results are presented as mean differences between before and after treatment.

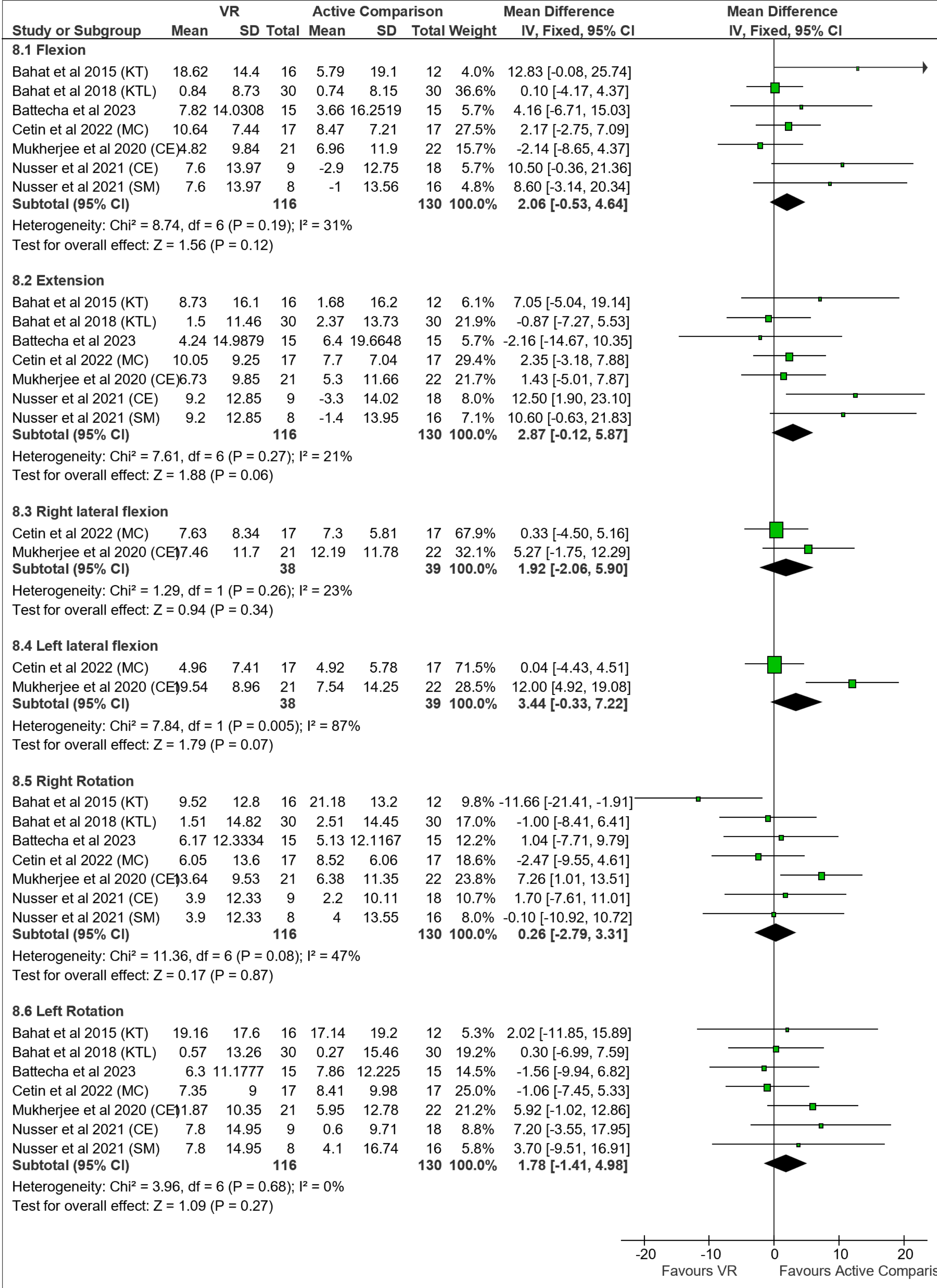


Figure 5. Figure 8. Comparison of virtual reality versus exercise on range of motion at end of treatment. The results are presented as mean differences between before and after treatment.

## Conclusion

Although the evidence is still limited for the VR treatment in patients with NP, the results found in this SR bring an important indication that the implementation of VR in existing rehabilitation for patients with neck pain appears to be a potentially safe and promising treatment approach to relieve pain and could be an alternative more effective to conventional exercise treatments that normally are employed in clinical practice.

Conflict of interest: No  
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