

VIRTUAL REALITY VERSUS STANDARD OF CARE FOR PAIN AND ANXIETY IN LOCAL ANAESTHETIC PROCEDURES: A META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS

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Abstract

This meta-analysis of four randomized controlled trials, encompassing 308 patients, investigated the effectiveness of immersive virtual reality (VR) in managing pain and anxiety during minor surgical procedures under local anaesthesia. The results demonstrate that immersive VR is a highly effective tool, significantly reducing intra-procedural pain levels as perceived, and decreasing anxiety levels afterward when compared to standard care. While it did not impact post-procedure pain, our findings confirm that VR is a valuable and practical non-pharmacological strategy to enhance the overall patient experience. The overall impact of VR on patient-reported outcomes during procedures performed under local anaesthesia was evaluated.

Methodology

A systematic review was performed using the PubMed and ScienceDirect databases. The search and screening process followed established PRISMA guidelines. A citation-searching (Scopus) approach using LitMap was used to identify over 200 additional sources.

Structured Screening: The Elicit AI tool applied specific inclusion criteria, which included adult populations, procedures under local or regional anaesthesia, and VR used as a distraction. Data extraction for key outcomes (pain, pre and post-anxiety, patient satisfaction) were extracted via an LLM-based parsing framework.

Results

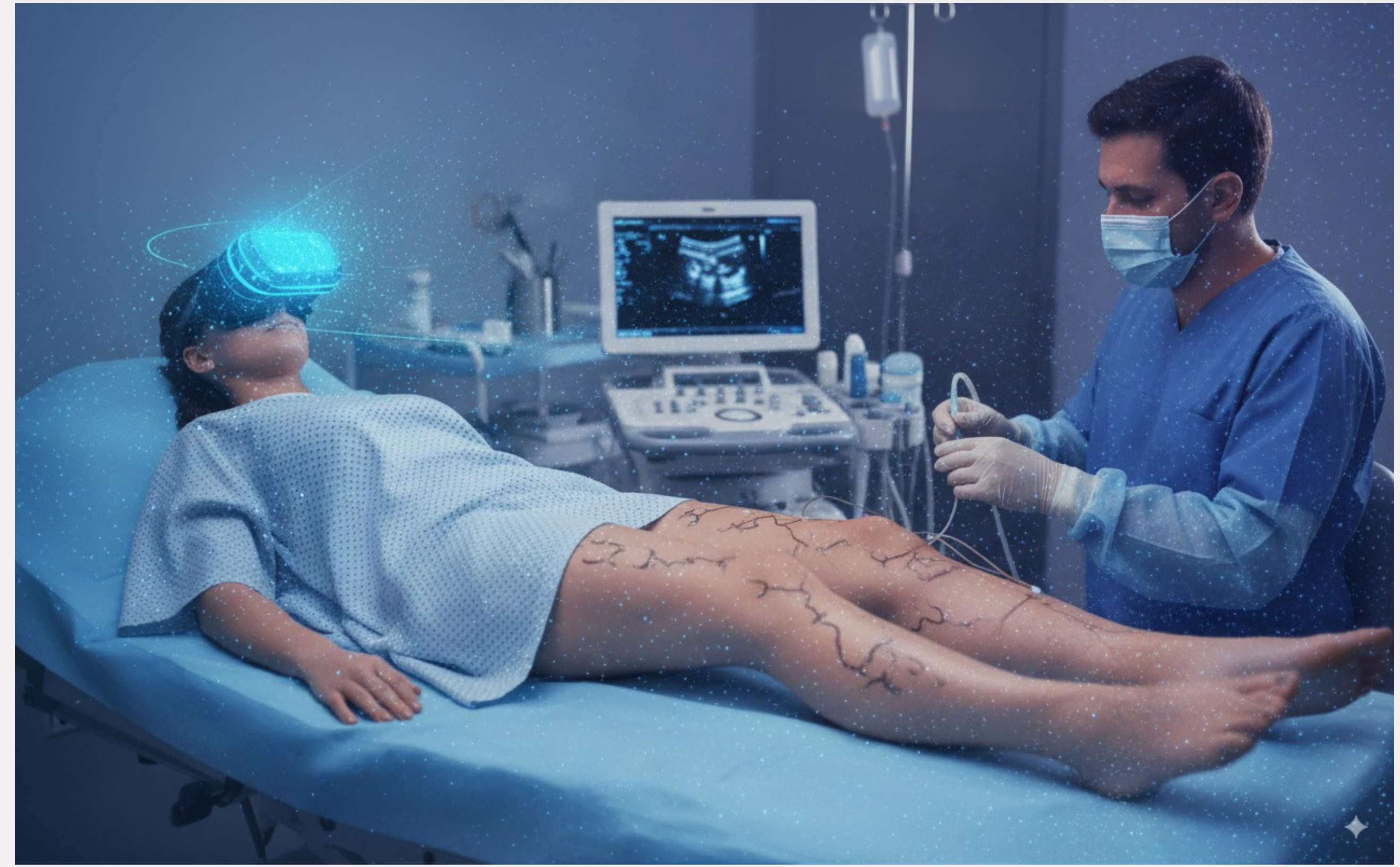
The final analysis included four randomized controlled trials, encompassing a total of 308 patients (155 in the VR group and 154 in the control group).

Key Findings:

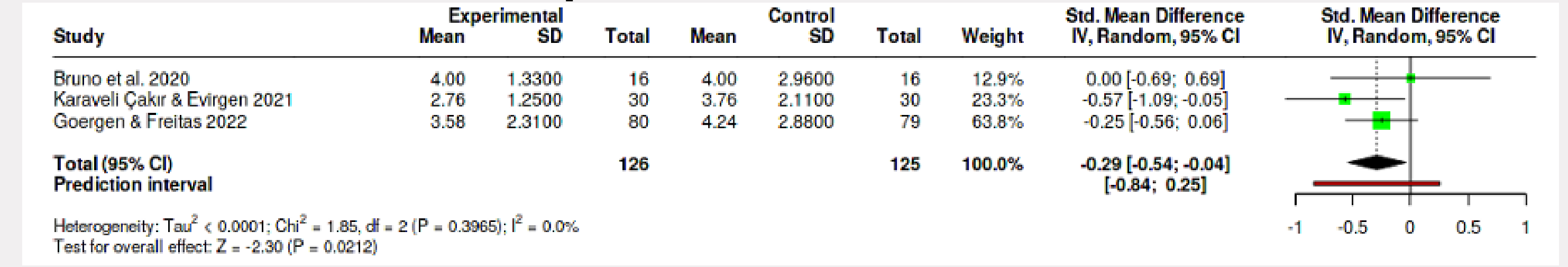
- Intra-Procedural Pain: The VR group experienced a significant reduction in pain during the procedure compared to the control group (SMD: -0.29, 95% CI, -0.54 to -0.04; p<0.05).
- Post-Procedure Pain: There are no significant differences in pain levels reported after the procedure (SMD: -0.12, 95% CI, -0.58 to 0.35).
- Pre-Procedure Anxiety Levels were similar between the VR and control groups before the intervention (Standardised Mean Difference (SMD: -0.13, 95% CI, -0.35 to 0.09).
- Post-Procedure Anxiety: The VR group showed a significant reduction in anxiety following the procedure (SMD: -0.48, 95% CI, -0.85 to -0.12; p<0.05).

Conclusion

This meta-analysis indicates that VR is an effective tool for managing patient distress during minor procedures performed with local anaesthesia. Specifically, VR significantly reduces pain during the procedure and anxiety after the procedure. While VR did not impact post-procedural pain, these findings suggest it is a promising non-pharmacological adjunct to enhance overall patient comfort and experience in a clinical setting.

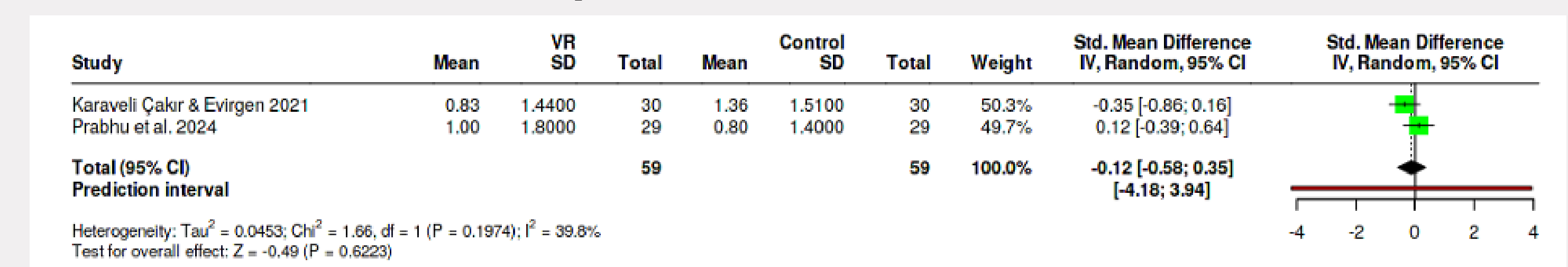


Patient Reported Pain Intra - Procedure



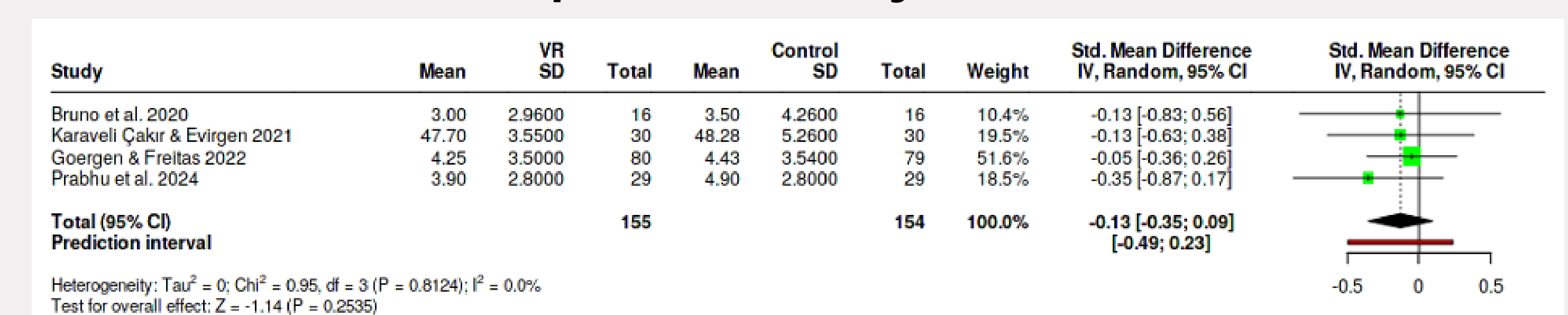
This chart brings together the results from three studies to see how much pain patients felt during their medical procedure. When the findings were combined, it became clear that the experimental group experienced significantly less pain than the control group. The overall effect size (a Standardized Mean Difference) was -0.29 in favour of the experimental group. The consistency of this result across the studies was excellent ($I^2=0.0\%$), strengthening the conclusion.

Patient Reported Pain Post - Procedure



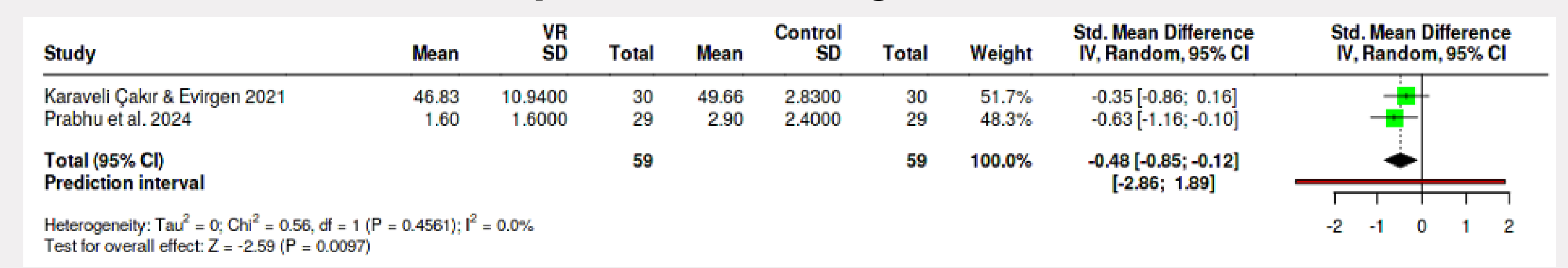
This analysis looks at patient-reported pain after the procedure was completed, using data from two studies. The combined results did not show a clear difference in pain levels between the two groups. While there was a slight trend towards less pain in the experimental group, the finding wasn't statistically significant, meaning the difference could have been due to chance. The results from the two studies also had some moderate variation ($I^2=39.8\%$).

Patient Reported Anxiety Pre - Procedure



This chart compares the anxiety levels of patients from four studies before the procedure began. The analysis confirms that both the experimental and control groups started out with similar levels of anxiety. This is an important check, as it shows the groups were well-balanced from the very beginning. The findings across all four studies were very consistent ($I^2=0.0\%$).

Patient Reported Anxiety Post - Procedure



This analysis reviews patient anxiety after the procedure, based on two studies. The results show a clear and statistically significant benefit for the experimental group. Patients in this group reported much lower levels of anxiety compared to the control group, with a moderate effect size of 0.48. The findings from both studies were in strong agreement, showing a consistent effect ($I^2=0.0\%$).

Summary of Meta-Analysis Results

Outcome	Timepoint	#	Number of Studies	Number of Participants	SMD [95% CI]	p-value	Heterogeneity (I2)	Publication Bias (Egger's test p-value)
Pain	Pre-procedure	1	1	Not Available	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Intra-procedure	3	3	251	-0.29 [-0.54 to -0.04]	0.02	0.00%	0.966
	Post-procedure	2	2	118	-0.12 [-0.58 to 0.35]	0.62	39.80%	Not Applicable
Anxiety	Pre-procedure	4	4	309	-0.13 [-0.35 to 0.09]	0.25	0.00%	0.412
	Intra-procedure	1	1	Not Available	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Post-procedure	2	2	118	-0.48 [-0.85 to -0.12]	<0.01	0.00%	Not Available

This table summarizes the results of a meta-analysis on patient reported pain and anxiety at pre-procedural, intra-procedural, and post-procedural timepoints. The analysis revealed a statistically significant reduction in intra-procedural pain (SMD: -0.29) and post-procedural anxiety (SMD: -0.48) favouring the experimental group. Conversely, no statistically significant difference between the cohorts was found for post-procedural pain or pre-procedural anxiety. Pre-procedural pain and intra-procedural anxiety were not analysed, as only one study reported each outcome. Across all performed analyses, there was no significant statistical heterogeneity, indicating that the effect sizes were consistent. Where enough studies were available for testing, no potential publication bias was detected.