

BACKGROUND

Craniomaxillofacial surgeons address congenital, developmental, and acquired deformities of the cranium, face, and jaws, relying on precise planning for optimal outcomes. Virtual Surgical Planning (VSP) integrates digital imaging and computer-aided design to enhance preoperative planning and intraoperative precision. hinder patient understanding and decision-making.

OBJECTIVES

To evaluate the impact of VSP on surgical accuracy, operative time, and cost-effectiveness in craniomaxillofacial procedures through a systematic review and meta-analysis of studies published between 2013 and 2023 (Figure 1).

METHODS

A systematic review and meta-analysis were conducted across databases, focusing on studies published between 2013 and 2023. Search terms included 'Virtual Surgical Planning,' 'VSP,' 'Surgical Planning,' '3D Printing,' and 'Craniofacial Surgeries' or 'Craniomaxillofacial Surgeries.' Articles that reported outcomes on operative time, accuracy, or cost were included.

RESULTS

A total of 146 studies were included in the final analysis. The outcomes were categorized into 3 key areas: accuracy, operative time, and cost-effectiveness. VSP showed a median deviation of 1.14 mm compared to 1.83 mm for non-VSP (P = 0.46). VSP groups had an average angular deviation of 2.67°, compared to 3.32° for non-VSP groups (P = 0.805). The average matching percentage was 96.12% for VSP, compared to 87.5% for non-VSP (P = 0.264). Operative time for VSP was 3.7 hours compared to 4.32 hours for non-VSP (P = 0.477) (Figure 2). Cost analysis showed VSP at lower average material cost (\$2128) compared to non-VSP (\$3416) (P = 0.294) (Table 1).

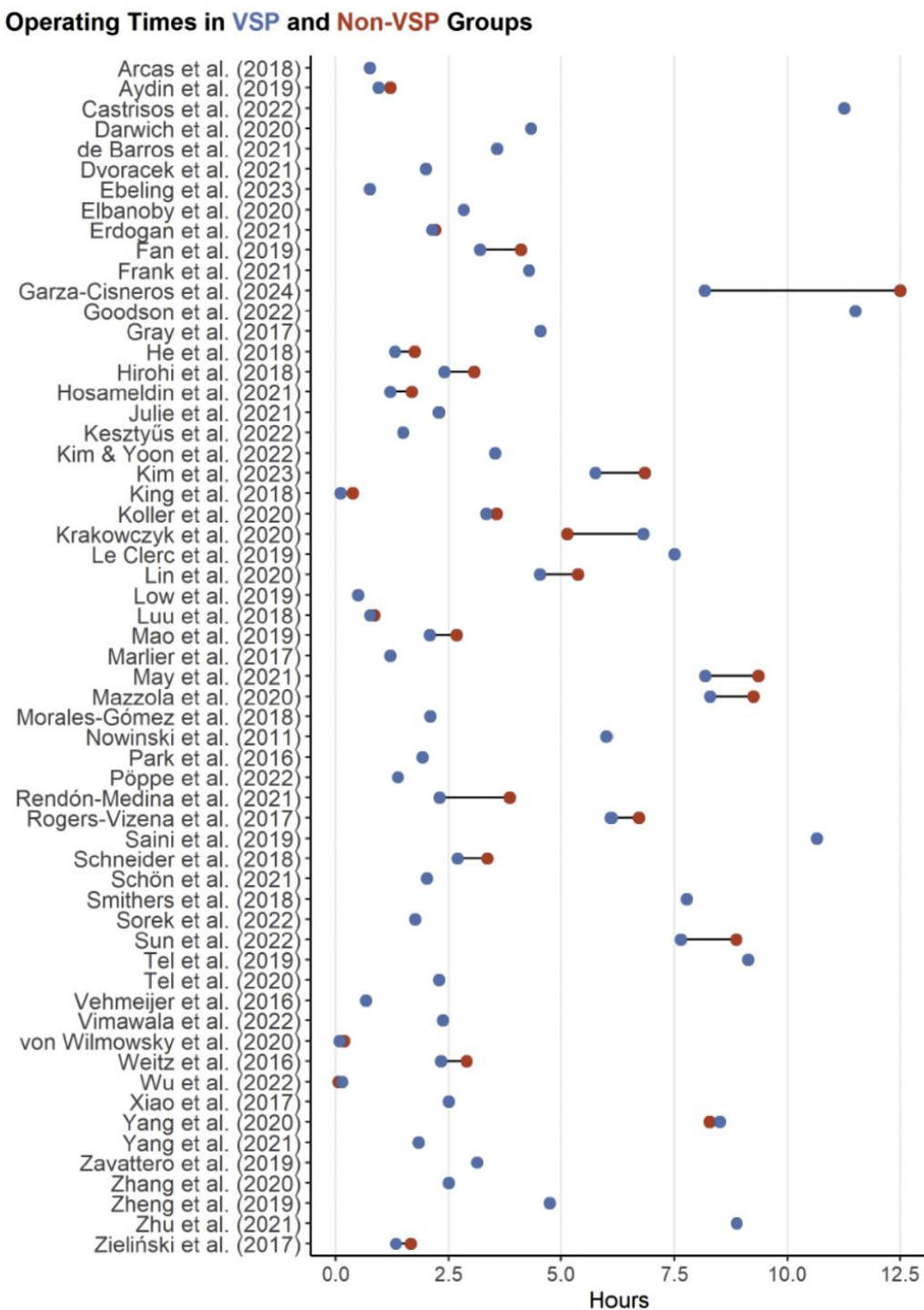


Figure 2.

CONCLUSIONS

Although numerous studies highlight the advantages of VSP in the craniomaxillofacial field, our meta-analysis found no statistically significant differences compared to traditional methods. Variability in study designs and outcome measures may contribute to these findings, highlighting the need for more standardized, procedure-specific research to fully assess the clinical impact of VSP.

OUTCOME	VSP	NON-VSP	P-VALUE
Median Deviation	1.14 mm	1.83 mm	0.46
Angular Deviation	2.67°	3.32°	0.805
Matching %	96.12%	87.5%	0.264
Operative Time	3.7 hrs	4.32 hrs	0.477
Material Cost	\$2,128	\$3,416	0.294

Table 1.

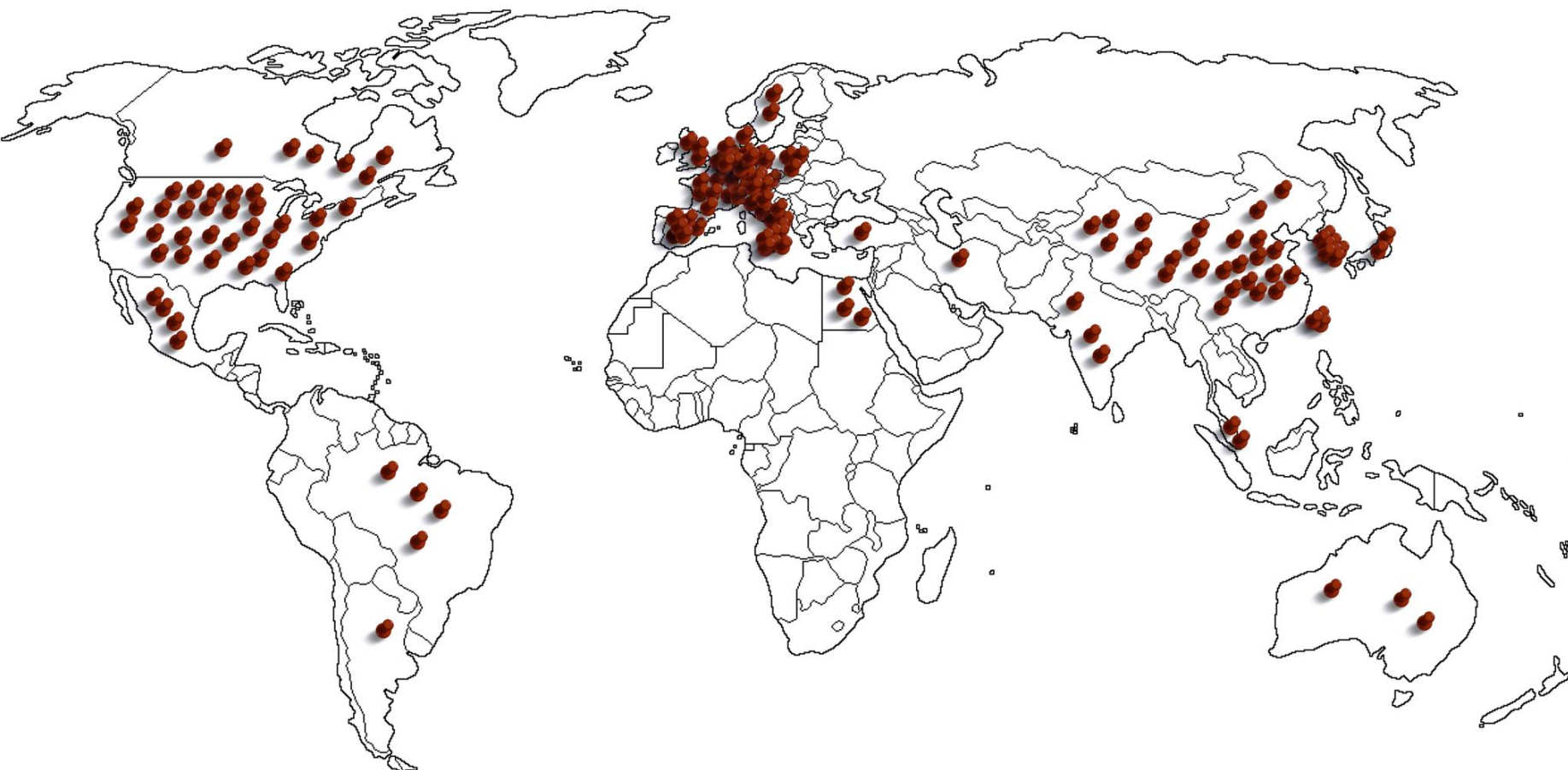


Figure 1.