

Performance of digital data acquisition technologies for the fabrication of maxillofacial prosthesis - A systematic review

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How to cite this article: Divya Kamnani¹ Dr. Saeed Deshpande² Dr. Neelam Pande³ Dr. Shikha Chhangani⁴ Dr. Shubham Bhavane⁵. Performance of digital data acquisition technologies for the fabrication of maxillofacial prosthesis - A systematic review. Int J Drug Deliv Technol. 2026;16(83s):266-278. DOI: 10.25258/ijddt.16.83s.30.

INTRODUCTION

Maxillofacial defects resulting from congenital anomalies, trauma, infections, or ablative surgery for benign and malignant diseases can profoundly affect facial esthetics and compromise essential functions such as mastication, speech, deglutition, vision, and respiration. These defects often lead to significant psychological distress and reduced quality of life, making comprehensive rehabilitation an integral component of patient care. Although surgical reconstruction remains the preferred treatment whenever feasible, prosthetic rehabilitation continues to play a crucial role in restoring facial form, function, and patient confidence, particularly in patients for whom surgical reconstruction is not feasible or predictable. Conventional fabrication of maxillofacial prostheses involves multiple clinical and laboratory procedures, including impression making, cast fabrication, wax pattern sculpting, mold preparation, silicone processing, and characterization. While this approach has demonstrated predictable clinical outcomes, it is technique-sensitive, labor-intensive, time-consuming, and highly dependent on operator skill, often

requiring multiple patient visits and causing discomfort during impression procedures.

The rapid evolution of digital dentistry has transformed the fabrication of maxillofacial prostheses by integrating three-dimensional (3D) data acquisition, virtual prosthesis design, and computer-aided manufacturing into clinical workflows. Digital technologies enable accurate capture of complex craniofacial anatomy using imaging modalities such as CT, CBCT, MRI, laser scanning, structured-light scanning, stereophotogrammetry, facial scanning, and intraoral scanning, followed by virtual design and fabrication through CAD/CAM systems and additive manufacturing. These technologies have the potential to improve accuracy, reproducibility, treatment efficiency, digital record preservation, and patient comfort while reducing dependence on conventional impression procedures. [1–4]

The clinical application of digital data acquisition has progressively expanded across different types of maxillofacial prostheses. Early reports demonstrated the feasibility of digitally assisted fabrication of orbital

protheses using three-dimensional imaging and CAD/CAM technologies, establishing the foundation for digital rehabilitation in maxillofacial prosthodontics. [5–11] Subsequently, digital workflows were adapted for nasal and auricular protheses, where advances in surface scanning and virtual design improved prosthesis accuracy and streamlined fabrication. [12–16] More recently, digital technologies have been increasingly incorporated into the fabrication of obturators and other intraoral protheses. Although fully digital workflows have been described, many studies continue to advocate hybrid approaches that combine digital data acquisition with conventional laboratory procedures to overcome current clinical and technical limitations. Collectively, these investigations have reported encouraging outcomes with respect to dimensional accuracy, treatment efficiency, reproducibility, esthetics, and patient satisfaction; however, considerable variability remains in the choice of acquisition technologies, software platforms, manufacturing techniques, study designs, and outcome measures. [17–27]

Several reviews have highlighted the growing role of digital technologies in maxillofacial prosthodontics and summarized individual digital workflows or specific clinical applications. [1–4] However, the available evidence has not been comprehensively synthesized according to the **performance of individual digital data acquisition technologies** across different maxillofacial prosthesis types. Given the rapid evolution of digital imaging systems and the increasing adoption of digital workflows in clinical practice, a critical appraisal of the available evidence is required. Therefore, the present systematic review aimed to evaluate the performance of digital data acquisition technologies used in the fabrication of maxillofacial protheses by comparing their reported clinical applications, accuracy, efficiency, patient-related outcomes, and practical applicability across different prosthesis types.

2. MATERIAL AND METHODS

2.1 Study Design

This systematic review was conducted in accordance with the **Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020** guidelines. The review protocol was prospectively registered

with the **International Prospective Register of Systematic Reviews (PROSPERO)** (Registration No.: CRD42024623315). The review question was formulated using the Population, Intervention, Comparator, and Outcome (PICO) framework to evaluate the clinical performance of digital data acquisition technologies used in the fabrication of maxillofacial protheses.

The PICOS framework was used to define the eligibility criteria.

The **population** included patients presenting with maxillofacial defects rehabilitated prosthetically using digital workflow.

The **intervention** consisted of various digital data acquisition technologies.

The **comparator** is the conventional/traditional non digital data acquisition technologies.

The **outcomes** evaluated were treatment time, aesthetic results, cost-effectiveness, dimensional accuracy, patient satisfaction, and the overall fabrication workflow associated with each technique.

Focused Question:

“How effective are digital data acquisition technologies in the fabrication of maxillofacial protheses for the management of maxillofacial defects?”

2.2 Search Strategy

A comprehensive literature search was performed to identify studies evaluating the application of digital data acquisition technologies in the fabrication of maxillofacial protheses. Electronic databases, including **PubMed/MEDLINE and google scholar** were searched from January 2020 and June 2026. To minimize publication bias, a manual search of the reference lists of all eligible studies and relevant review articles was also performed. Grey literature was searched using Google Scholar.

The search strategy combined controlled vocabulary (Medical Subject Headings [MeSH]) and free-text terms related to maxillofacial protheses and digital technologies. Keywords included combinations of *maxillofacial prosthesis, orbital prosthesis, auricular prosthesis, nasal*

prosthesis, obturator, digital workflow, digital impression, three-dimensional imaging, facial scanning, stereophotogrammetry, laser scanning, computed tomography, magnetic resonance imaging, computer-aided design, and computer-aided manufacturing. Boolean operators ("AND" and "OR") were used to combine search terms, and the search strategy was modified appropriately for each database. The complete search strategy for PubMed was

```
("Maxillofacial Prosthesis"[Mesh]
OR maxillofacial prosthesis*[tiab]
OR facial prosthesis*[tiab]
OR ocular prosthesis*[tiab]
OR orbital prosthesis*[tiab]
OR eye prosthesis*[tiab]
OR auricular prosthesis*[tiab]
OR ear prosthesis*[tiab]
OR nasal prosthesis*[tiab]
OR nose prosthesis*[tiab]
OR obturator*[tiab]
)
AND
(
digital workflow[tiab]
OR digital technology*[tiab]
OR digital acquisition[tiab]
OR data acquisition[tiab]
OR computer-aided design[tiab]
OR CAD/CAM[tiab]
OR rapid prototyping[tiab]
OR additive manufacturing[tiab]
OR stereophotogrammetry*[tiab]
OR photogrammetry*[tiab]
OR laser scan*[tiab]
OR structured light scan*[tiab]
OR optical scan*[tiab]
OR facial scan*[tiab]
OR 3D photograph*[tiab]
OR 3D imaging[tiab]
OR computed tomography[tiab]
OR computerized tomography[tiab]
OR CT[tiab]
OR cone beam computed tomography[tiab]
OR CBCT[tiab]
OR magnetic resonance imaging[tiab]
OR MRI[tiab]
OR intraoral scan*[tiab]
)
NOT
(
implant-supported[tiab]
OR implant prosthesis*[tiab]
OR osseointegrated implant*[tiab]
)
```

2.3 Eligibility Criteria

Studies were selected according to predefined eligibility criteria established before the literature search.

Studies were excluded if they were review articles, technical reports, editorials, letters to the editor, conference abstracts without full-text availability, animal studies, in vitro investigations, or articles not published in English. Publications lacking sufficient methodological details or outcome data relevant to the objectives of this review were also excluded.

Table 1. Eligibility Criteria

Inclusion Criteria	Exclusion Criteria
Case reports and case series that describe the use of digital technologies for non-surgical prosthetic rehabilitation of maxillofacial defects.	Review articles and meta-analyses, narrative, or literature reviews
The rehabilitation of maxillofacial abnormalities without implant-supported prosthetic therapy is covered in case reports and case series.	Technical reports, editorials, letters
English-language full-text articles	Animal and in vitro studies
	Conference abstracts without full text
	Studies with insufficient outcome data
	Articles written in languages other than English

2.4 Study Selection

All retrieved records were imported into reference management software, and duplicate citations were removed prior to screening. Two reviewers (DK,SD) independently screened the titles and abstracts of the identified records to determine their eligibility. Articles considered potentially relevant underwent full-text assessment based on the predefined inclusion and exclusion criteria. Any disagreement

regarding study eligibility was resolved through discussion, and when consensus could not be reached, consultation with a third reviewer(NP) was undertaken. The study selection process is illustrated in the PRISMA 2020 flow diagram.

2.5 Data Extraction

A standardized data extraction form was developed before the review to ensure consistent collection of information from all included studies. Data extraction was performed independently by two reviewers(DK,SD), and discrepancies were resolved through discussion until consensus was achieved.

The extracted variables included the first author, year of publication, study design, prosthesis type, participant characteristics, defect classification, digital data acquisition technology, comparator (where applicable), workflow type (fully digital or hybrid), manufacturing technique and outcome measures. Additional information relevant to the clinical applicability of the digital workflow was also recorded whenever available.

2.6 Risk of Bias Assessment:

The methodological quality and risk of bias of the included studies were assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklists. The JBI Critical Appraisal Checklist for Case Reports was used to assess individual case reports and clinical reports, whereas the JBI Critical Appraisal Checklist for Case Series was used for case series. The assessment evaluated the methodological quality and completeness of reporting of each included study.

2.7 Quality Assessment

The methodological quality of the included studies was independently assessed by two reviewers using appraisal tools appropriate for the respective study designs. The **Joanna Briggs Institute (JBI) Critical Appraisal Checklists** were used for case reports and case series. The assessment evaluated the methodological rigor, reporting quality, selection of participants, outcome assessment, and potential sources of bias. Any differences in quality assessment were resolved by discussion until consensus was reached.

2.8 Data Synthesis

Considerable heterogeneity was observed among the included studies with respect to prosthesis type, digital data acquisition technology, study design, workflow characteristics, manufacturing techniques, comparator methods, and reported outcome measures. Therefore, quantitative synthesis by meta-analysis was not considered appropriate.

A descriptive narrative synthesis was undertaken, and the included studies were grouped according to the type of maxillofacial prosthesis and the digital data acquisition technology employed. Findings related to dimensional accuracy, treatment efficiency, fabrication time, patient satisfaction, esthetic outcomes, and clinical applicability were critically compared to identify current evidence, common trends, and existing knowledge gaps.

3. RESULTS

3.1 Study Selection

The literature search identified **165** records through electronic database searching, with additional studies (11) retrieved through manual searching and reference screening. After removal of duplicates, **176** records were screened by title and abstract. Following full-text assessment, **23 studies** met the predefined eligibility criteria and were included in the qualitative synthesis (Figure 1).

Figure 1- Prisma chart

3.2 Characteristics of Included Studies

The included studies were published between **2020 and 2026**. The studies investigated digital data acquisition technologies for the fabrication of **orbital (n = 7), nasal (n = 1), auricular (n = 4), and obturator prostheses (n = 11)**. The majority of studies employed either fully digital or hybrid digital workflows integrating CAD/CAM technology and additive manufacturing for prosthesis fabrication (**Table 2**).

3.3 Risk of Bias Assessment:

The risk of bias assessment of the included studies is presented in **Table 3**. Overall, the included studies demonstrated predominantly moderate methodological quality. Most studies adequately described patient demographics, clinical history, clinical condition, diagnostic procedures, interventions, and immediate

clinical outcomes. However, adverse events were frequently not explicitly reported, and long-term follow-up was limited or unclear in several studies. Among the included case series, participant selection methods, consecutive inclusion, and completeness of inclusion were commonly unclear.

3.4 Digital Data Acquisition Technologies

A broad spectrum of digital data acquisition technologies was identified across the included studies. Facial scanning techniques—including handheld three-dimensional scanners, structured-light scanners, automated facial topography mapping, and photogrammetry—were predominantly used for orbital, nasal, and auricular prostheses. CT, CBCT, optical scanning, stereolithography-based image acquisition, and intraoral scanners were mainly employed for obturator rehabilitation. Most studies integrated digital data acquisition with CAD software and additive manufacturing, whereas hybrid workflows combined digital acquisition with conventional laboratory procedures. Studies by **Weisson et al., Sun et al., Bansod et al., Dahlan et al., Kumar et al., Ciocca et al., Netshilindi et al., Koul et al., Ogami et al., Saadellaoui et al., Naydenov et al., Borel et al., and Mouri et al.** demonstrated the successful incorporation of these technologies into clinical workflows.

3.5 Clinical Outcomes According to Prosthesis Type

3.5.1 Orbital Prostheses

Seven studies evaluated digital workflows for orbital prosthesis fabrication. Automated facial topography mapping, facial photogrammetry, handheld facial scanners, and CAD/CAM-assisted workflows were the principal acquisition methods. Across these studies, digital workflows consistently improved prosthesis adaptation, facial symmetry, esthetics, retention, patient comfort, and workflow efficiency while reducing treatment complexity and clinical visits. Pediatric rehabilitation particularly benefited from impression-free digital workflows. **(Refs. 5–11)**

3.5.2 Nasal Prostheses

One study evaluated a hybrid digital workflow for nasal prosthesis fabrication using facial scanning, CAD modelling, and three-dimensional printing. The digital approach resulted in a lightweight prosthesis, simplified

fabrication, shorter treatment time, and improved patient quality of life compared with conventional fabrication. **(Ref. 12)**

3.5.3 Auricular Prostheses

Four studies investigated auricular prosthesis fabrication using digital impressions, indirect scanning, CAD/CAM, rapid prototyping, and additive manufacturing. Regardless of workflow type, the studies consistently reported improved dimensional accuracy, esthetics, prosthesis adaptation, predictable fabrication, reduced clinical time, and greater patient acceptance than conventional techniques. **(Refs. 13–16)**

3.5.4 Obturator Prostheses

Eleven studies evaluated digital technologies for obturator and feeding obturator fabrication. Frequently employed acquisition methods included intraoral scanning, optical scanning, CT, CBCT, stereolithographic modelling, CAD software, selective laser melting, CAD/CAM milling, and three-dimensional printing. These technologies improved prosthesis fit, retention, stability, mastication, speech, swallowing, patient comfort, and treatment efficiency while reducing the number of clinical appointments. Several studies also reported successful impression-free rehabilitation and fabrication of lightweight prostheses. **(Refs. 17–27)**

3.6 Synthesis of Clinical Outcomes

Across all included studies, the most frequently evaluated outcomes were dimensional accuracy, esthetics, patient satisfaction, treatment efficiency, workflow efficiency, and cost-effectiveness. Improvements in esthetics and patient satisfaction were reported across all prosthesis types, whereas reduced treatment time and fewer clinical visits were observed mainly in studies employing fully digital workflows. Hybrid workflows demonstrated comparable clinical performance while retaining selected conventional laboratory procedures. Intraoral and facial scanning technologies consistently reduced patient discomfort by minimizing or eliminating conventional impression procedures. Although the overall findings favored digital data acquisition technologies, the available evidence primarily consisted of case reports and case series with heterogeneous study designs and outcome measures.

4. DISCUSSION

The present review demonstrates that digital data acquisition technologies have become an effective alternative to conventional impression techniques for maxillofacial prosthesis fabrication. Across the included studies, improvements were consistently observed in dimensional accuracy, esthetics, patient comfort, and workflow efficiency, irrespective of prosthesis type. However, the choice of digital acquisition method varied according to the anatomical defect and clinical requirements, with facial scanners predominantly used for extraoral prostheses and intraoral scanners or CT-based imaging preferred for obturator rehabilitation.⁵⁻²⁷

Among orbital prostheses, Weisson et al.⁵ demonstrated excellent facial symmetry and accurate prosthesis adaptation using automated facial topography mapping, whereas Sun et al.⁶ highlighted the clinical advantages of handheld facial scanning in pediatric patients by eliminating conventional impressions. Similarly, Bansod et al.⁹ employed facial photogrammetry, while Dahlan et al.¹⁰ utilized extraoral facial scanning with a 3D-printed model; both reported simplified workflows and improved esthetic outcomes despite differences in acquisition techniques. Kumar et al.¹¹ further demonstrated that digital facial scanning provided predictable rehabilitation with high patient satisfaction. Likewise, Ciocca et al.¹² successfully combined facial scanning with CAD modelling for nasal prosthesis fabrication, reporting reduced treatment time and improved quality of life. These findings suggest that various facial scanning technologies provide comparable clinical outcomes for extraoral rehabilitation, although the selected technology is largely dictated by defect characteristics and equipment availability.

For auricular prostheses, all studies reported favorable outcomes despite variations in workflow. Netshilindi et al.¹³ used digital impressions with CAD/CAM and rapid prototyping, whereas Mazaheri Tehrani et al.¹⁴ incorporated indirect scanning into a hybrid workflow. Koul et al.¹⁵ and Gupta et al.¹⁶ further demonstrated that digital scanning combined with additive manufacturing improved fabrication accuracy and esthetics while reducing clinical time. Although some studies adopted fully digital workflows and others retained conventional laboratory processing, all consistently reported improved prosthesis adaptation and patient acceptance, indicating that digital acquisition rather than

the manufacturing approach may be the principal contributor to successful rehabilitation.

Greater heterogeneity was observed among obturator studies because of the complexity of intraoral defects. Trivedi et al.¹⁷ and Ogami et al.²⁰ demonstrated that CAD/CAM-fabricated PEEK and PEKK obturators reduced prosthesis weight and improved patient comfort, whereas Rathee et al.¹⁸ and Saadellaoui et al.²¹ showed that hybrid workflows integrating digital acquisition with conventional laboratory procedures improved retention, speech, and mastication. In contrast, Naydenov et al.²³, Gomes et al.²⁵, and Borel et al.²⁶ reported successful fully digital workflows that eliminated conventional impressions and reduced clinical appointments. Similarly, Muddasani et al.²² and Mouri et al.²⁷ demonstrated that digital acquisition facilitated safer and more efficient rehabilitation in cleft palate patients. These findings indicate that fully digital workflows are feasible for selected obturator cases, although hybrid workflows remain valuable when functional impressions or border molding are required.

Overall, the findings of this review agree with previous systematic reviews, which concluded that digital technologies improve workflow efficiency, prosthesis accuracy, esthetic outcomes, and patient satisfaction compared with conventional methods.¹⁻⁴ Nevertheless, the evidence remains limited by the predominance of case reports and case series, heterogeneous digital acquisition systems, and inconsistent outcome assessment. Future well-designed comparative clinical studies with standardized outcome measures are required to establish evidence-based guidelines for selecting the most appropriate digital data acquisition technology for different maxillofacial prostheses.

Table 2- Characteristics of included studies

S	Aut	Stud	Popula	Digital	Com	Hyb	Outc
r	hor	y	tion/D	l Data	parat	rid	ome
·	(Ye	Desi	effect	Acqui	or	wor	s
n	ar)	gn		sition	(Con	Digi	Rep
o				(Inter	venti	tal	orte
				ventio	onal)	Wor	d
				n)		kflo	
						w	

1.	Wei et al. (2020)	Interventional Case Series	Three orbital exenterations	Automated non-contact facial topography mapping, CAD design, 3D printing	Ocularist-made conventional prosthesis	Full Digital	Excellent symmetry, accurate fit, improved skin-tone match, reproducible workflow, reduced fabrication cost. Impression-free workflow, reduced cost, improved comfort, ideal for pediatric patients.
2.	Sun et al. (2022)	Case Report	13-year-old child after orbital exenteration	Hand-held 3D facial scanner, mirror-image CAD, 3D printing	Conventional impression	Full Digital	Improved retention, esthetics, adaptation, and simplified
3.	Rathee et al. (2023)	Case Report	Combined orbital and maxillary defect after mucormycosis	Hybrid digital workflow using digital technology with conventional	Conventional analogue rehabilitation	Hybrid	

8	Ciocca et al. (2023)	Case Report	Cancer patient with post-surgical mid-facial defect	Facial scanner, CAD modeling, 3D printing, laser-melted framework	Conventional facial prosthesis fabrication	Hybrid	Reduced weight, simplified fabrication, reduced treatment time, improved quality of life.	Indirect scanner used to create digital resin model after impression; CAD/CAM and 3D printing	Conventional manual wax pattern fabrication	Hybrid-CAD/CAM, 3D printed model for patient esthetics, fabrication not satisfactory	Adaptation
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Auricular prosthesis

	Netshili et al. 2023	Case Report	Adult patient with auricular defect	Digital impression, CAD/CAM, STL modeling and rapid prototyping	Conventional manual sculpting	Hybrid	More accurate, less invasive, shorter fabrication time, better patient acceptance.	Digital scanning, additive manufacturing, 3D printed model	Conventional impression and manual sculpting	Hybrid	Greater accuracy, predictable fabrication, improved esthetics, reduced clinical time.
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	Gupta et al. (2025)	Case Report	12-year-old child with congenital right auricular defect	Advanced 3D digital workflow with digital design and fabrication of silicone auricle	Conventional manual fabrication	Full Digital	Improved accuracy, esthetics, efficiency, and patient acceptance.
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Obturator	lar prosthesis	ctomy defect	CAD/CAM milling of PEKK obturator	ced discomfort, improved fit, shorter treatment time. Reduced laboratory time, improved speech, swallowing and mastication.
Trivedi et al. (2022)	Post-COVID mucor mycosis maxillary defect	CAD/CAM milled PEEK obturator	Conventional acrylic obturator	Hybrid
Rathee et al. (2023)	Three post-COVID mucor mycosis patients	DMLS-designed partial denture with CAD	Conventional cast partial denture	Hybrid
Prihanto et al. (2023)	14-year-old with hemimaxillary defect	3D stereolithographic model	Conventional obturator fabrication	Hybrid
Ogami et al. (2023)	68-year-old male with post-maxillary	Optical impression, CAD software,	Conventional impression	Full Digital
Saadellou et al. (2024)	Clinical Report	Female with velopalatal defect	Intraoral scanner, CAD, selective laser melting	Conventional impression and framework fabrication

Mudda et al. (2024)	Case Series	Three term infants with unilateral cleft lip and palate (one with polydactyly and preauricular sinus; one with multicystic kidney disease)	Intraoral scanning (Meditraoral Scanner), CAD design, and 3D printing of a customized feeding obturator with nasal stent	Conventional impression-based obturator fabrication	Full Digital	Early establishment of breastfeeding, improved nutritional rehabilitation and weight gain, reduced facial deformity, improved nasal cartilage support and facial symmetry, enhanced feeding efficiency, safer impression-free workflow. No impression materials, improved	3D printing	Improved comfort, reduced appointments, cost-effective. Better comfort, improved accuracy, reduced chair time, improved esthetics and function. Lightweight prosthesis, easier insertion, improved quality of life. Reduced weight, comparable function, eliminated conventional
Shah et al. (2025)	Case Report	17-year-old female with oronasal fistula	Intraoral scanner, digital impression, 3D printed cast	Conventional impression	Hybrid			
Gomes et al. (2025)	Case Report	Large maxillary defect with severe trismus	Complete digital planning and 3D printing	Conventional obturator fabrication	Full Digital			
Borrel et al. (2025)	Proof-of-Concept Case Report	Patient with complex maxillary defect	CBCT, segmentation software, full digital design, 3D printing	Conventional flexible obturator	Full Digital			
Naydenov et al. (2025)	Case Report	Post-surgical maxillary defect	Intraoral scanner, Blender®, CAD, 3D printing	Conventional manual impression	Full Digital			

Mo uri 2 et 3 al. (20 26)	Cleft lip and palate patient with speech and mastic ation difficul ty	Digita l impres sion plus bite-sea ting impres sion	Conv entio nal impre ssion	Hyb rid	nal impr essio ns. Impr oved mast icati on, speech, safe impr essio n proc edur e, impr oved oral funct ion.	Prosth esis	Study	D D D D D D D D								Overa ll
								1	2	3	4	5	6	7	8	
							Dahlan et al. (2024)	Y	Y	Y	Y	Y	Y	U	Y	Moder ate
							Kumar et al. (2025)	Y	Y	Y	Y	Y	Y	U	Y	Moder ate
						Nasal	Ciocca et al. (2023)	Y	Y	Y	Y	Y	Y	U	U	Moder ate
						Auricu lar	Netshili ndi et al. (2023)	Y	Y	Y	Y	Y	Y	U	Y	Moder ate
							Mazahe ri Tehrani et al. (2023)	Y	Y	Y	Y	Y	Y	U	Y	Moder ate
							Gupta et al. (2025)	Y	Y	Y	Y	Y	Y	U	U	Moder ate
						Obtur ator	Trivedi et al. (2022)	Y	Y	Y	U	Y	Y	U	Y	Moder ate
							Prihant ono et al. (2023)	Y	Y	Y	Y	Y	Y	U	Y	Moder ate
							Ogami et al. (2023)	Y	Y	Y	Y	Y	Y	U	Y	Moder ate
							Saadell aoui et al. (2024)	Y	Y	Y	Y	Y	Y	U	Y	Moder ate
							Nayden ov et al. (2025)	Y	Y	Y	Y	Y	Y	U	Y	Moder ate
							Shayeg h et al. (2025)	Y	Y	Y	Y	Y	Y	U	Y	Moder ate
							Gomes et al. (2025)	Y	Y	Y	U	Y	Y	U	Y	Moder ate
							Borel et al. (2025)	Y	Y	Y	Y	Y	Y	U	Y	Moder ate
							Mouri et al. (2026)	Y	Y	Y	Y	Y	Y	U	Y	Moder ate

Table 3. JBI Risk of Bias Assessment

Y = Yes; U = Unclear; NA = Not Applicable

JBI Case Report Domains

- **D1:** Patient demographics
- **D2:** Patient history
- **D3:** Clinical condition
- **D4:** Diagnostic assessment
- **D5:** Intervention clearly described
- **D6:** Post-intervention condition
- **D7:** Adverse events
- **D8:** Outcomes/follow-up

A. Case Reports / Clinical Reports

Prosth esis	Study	D D D D D D D D								Overa ll
		1	2	3	4	5	6	7	8	
Orbita l	Sun et al. (2022)	Y	Y	Y	U	Y	Y	U	Y	Moder ate
	Rathee et al. (2023)	Y	Y	Y	Y	Y	Y	U	Y	Moder ate
	Pathak et al. (2023)	Y	Y	Y	Y	Y	Y	U	Y	Moder ate
	Bansod et al. (2024)	Y	Y	Y	Y	Y	Y	U	Y	Moder ate

B. Case Series

JBI Case Series Domains

- **S1:** Clear inclusion criteria
- **S2:** Condition measured consistently
- **S3:** Valid methods used to identify the condition
- **S4:** Consecutive inclusion
- **S5:** Complete inclusion
- **S6:** Demographics reported
- **S7:** Clinical information reported
- **S8:** Outcomes/follow-up reported
- **S9:** Clinical setting reported
- **S10:** Statistical analysis

Prothesis	Study	S	S	S	S	S	S	S	S	S	S	Over
esis		1	2	3	4	5	6	7	8	9	10	all
Orbital	Weiss et al. (2020)	U	Y	Y	U	U	Y	Y	Y	Y	N	Mode
											A	rate
Auricular	Koulet al. (2025)	U	Y	Y	U	U	Y	Y	Y	Y	N	Mode
											A	rate
Obturator	Rathee et al. (2023)	U	Y	Y	U	U	Y	Y	Y	Y	N	Mode
											A	rate
Obturator	Muddasani et al. (2024)	U	Y	Y	U	U	Y	Y	Y	Y	N	Mode
											A	rate

5. REFERENCES

1. Farook TH, Jamayet NB, Abdullah JY, Rajion ZA, Alam MK. A systematic review of the computerized tools and digital techniques applied to fabricate nasal, auricular, orbital and ocular prostheses for facial defect rehabilitation. *J Stomatol Oral Maxillofac Surg.* 2020;121(3):268-277.
2. Suresh N, Janakiram C, Nayar S, Krishnapriya VN, Mathew A. Effectiveness of digital data acquisition technologies in the fabrication of maxillofacial prostheses: a systematic review. *J Oral Biol Craniofac Res.* 2022;12(1):208-215.
3. Elbashti ME, Sumita YI, Kelimu S, Aswehlee AM, Awuti S, Hattori M, et al. Application of digital technologies in maxillofacial prosthetics literature: a 10-year observation of five selected prosthodontics journals. *Int J Prosthodont.* 2019;32(1):45-50.
4. Soriano CM, Vega PC, Devesa AE, Salas EJ, López JL. Frequency and type of digital

procedures used for the intraoral prosthetic rehabilitation of patients with head and neck cancer: a systematic review. *J Prosthet Dent.* 2022;127(5):811-815.

5. Weisson EH, Fittipaldi M, Concepcion CA, Pelaez D, Grace L, Tse DT. Automated noncontact facial topography mapping, 3-dimensional printing, and silicone casting of orbital prosthesis. *Am J Ophthalmol.* 2020;220:27-36. doi:10.1016/j.ajo.2020.06.032.

6. Sun MH, Tsai YJ, et al. [Pediatric orbital prosthesis study using a handheld three-dimensional facial scanner and digital workflow]. *Taiwan J Ophthalmol.* 2022;12(2). **Note:** I recommend verifying the complete author list and article title directly from the first page of the PDF before final submission. The uploaded article clearly corresponds to the 2022 pediatric digital orbital prosthesis study.

7. Rathee M, Chahal S, Alam M, Singh S, Divakar S. Surgical rehabilitation of a continuous orbital and maxillary defect from rhino-orbital mucormycosis utilising digital technology: a case report. *Ann Maxillofac Surg.* 2023;13(2):224-227. doi:10.4103/ams.ams_54_23.

8. Pathak A, Dhamande MM, Sathe S, Gujjelwar S, Khubchandani SR. Revolutionizing maxillofacial rehabilitation for ocular defects: the impact of three-dimensional printing and sublimation transfer technique on changing horizons. *Cureus.* 2023;15(11):e49706. doi:10.7759/cureus.49706.

9. Bansod AV, Pisulkar SK, Beri A, Jain R, Deshmukh S, Umre U. Innovative hybrid approach: digital and analog fabrication of orbital prosthesis for post-COVID-19 mucormycosis defects using photogrammetry technique. *Sci Rep.* 2024;14:26446. doi:10.1038/s41598-024-77836-2.

10. Dahlan A, Iradani PM. Custom made orbital prosthesis using digital approach: a case report. *World J Adv Res Rev.* 2024;23(1):997-1001. doi:10.30574/wjarr.2024.23.1.2089.

11. Kumar U, Garhnayak L, Patro TK, Dhal A, Acharya A, Belkhede S, et al. Digitally fabricated orbital prosthesis for the rehabilitation of orbital defects following squamous cell carcinoma (SCC). *Cureus.* 2025;17(5):e83489. doi:10.7759/cureus.83489.

12. Ciocca L, et al. [Digital workflow for fabrication of a nasal/facial prosthesis using facial scanning, CAD modelling, three-dimensional printing and a laser-melted framework]. 2023
13. Netshilindi N, Asia-Michaels W, Maart R. An innovative digital workflow for the fabrication of a prosthetic ear: a case report. **S Afr Dent J.** 2023;78(2). doi:10.17159/sadj.v78i02.16165.
14. Mazaheri Tehrani A, Zarbakhsh A, Rastin V, Karimi H. Fabrication of a silicon auricular prosthesis using a digital model: a clinical report. **J Basic Res Med Sci.** 2023;10(3):78-85.
15. Koul R. Fabrication of auricular prosthesis using additive manufactured model. **J Dent Def Sect.** 2025;19:59-63.
16. Gupta A, Saxena A, Mangtani V, Pursnani RA. Digital fabrication of a custom auricular prosthesis for congenital microtia of right ear: a case report. **J South Asian Assoc Pediatr Dent.** 2025. doi:10.5005/jp-journals-10077-3401.
17. Trivedi A, Agarwal S, Mowar A, Goswami R, Tyagi M. Futuristic rehabilitation technique of acquired maxillectomy defect in post COVID-19 mucormycosis using polyether ether ketone obturator prosthesis: a case report. **J Pharm Negat Results.** 2022;13(Special Issue 10):2212-2218. doi:10.47750/pnr.2022.13.S10.258.
18. Rathee M, Divakar S, Jain P, Singh S, Chahal S. Prosthetic rehabilitation of mucormycosis patients using DMLS fabricated cast partial denture with semi-precision attachments: a case series. **Spec Care Dentist.** 2023;1-8. doi:10.1111/scd.12902.
19. Prihantono, Rahman A, Faruk M, Rusdin MHS, Inriany N, Binekada IMC. Hemimaxillectomy defect reconstruction with a maxillary obturator prosthesis using a 3D-model stereolithography: a case report. **Int J Surg Case Rep.** 2023;108:108431. doi:10.1016/j.ijscr.2023.108431.
20. Ogami K, Hagio M, Ueda T. Maxillary obturator prosthesis made with polyetherketoneketone using optical impression and CAD/CAM system. **Tokyo Dent Coll Publ.** 2023;64(1):31-37. doi:10.2209/tdcpublication.2022-0020.
21. Saadellaoui I, Bekri S, Labidi A, ben Yaala M, Mabrouk Y, Mansour L. Combination of CAD/CAM technologies and conventional processing in the fabrication of a maxillary obturator prosthesis: a clinical report. **J Med Life.** 2024;17(3):375-380. doi:10.25122/jml-2024-0017.
22. Muddasani V, Kamalakannan SK, Harish S, Arun A, Kumutha J. The use of ultrasound-guided 3D-constructed obturator device in the management of cleft lip and palate: a case series. **Cureus.** 2024;16(7):e64948. doi:10.7759/cureus.64948.
23. Naydenov A, Radev R, Slavkov S, Gerdzhikov I. Fully digital fabrication of maxillary obturator by enhancing rough scan data with Blender®: a case report. **Cureus.** 2025;17(6):e85698. doi:10.7759/cureus.85698.
24. Shayegh SS, Mohammadi Z, Bafandeh MA, Nazemalroaya MR. The use of an intraoral scanner for the fabrication of maxillary obturator prosthesis in a young adult with oronasal fistula: a case report. **Case Rep Dent.** 2025.
25. Gomes et al. Digital workflow for a two-piece hollow bulb obturator in maxillary defect rehabilitation: a clinical case report. **Case Rep Dent.** 2025.
26. Borel O, Derman D, Lescaille G, Pomes B. Flexible obturator with a full digital workflow: a proof-of-concept case report. **Cureus.** 2025;17(12):e98262. doi:10.7759/cureus.98262.
27. Mouri Y, Murase M, Matsui S, Wada J, Wakabayashi N. Use of digital technology in maxillofacial prosthetic treatment of cleft lip and palate in patients with severe periodontitis: a case report. **J Prosthodont Res.** 2026;70(2):324-330. doi:10.2186/jpr.JPR_D_25_00061.