Original Article

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Functional Outcome and Quality of Life after Prosthetic Rehabilitation in Patients with Maxillofacial Defects: A Systematic Review

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ABSTRACT

Introduction: Maxillofacial prosthetics is a branch of dentistry focused on addressing congenital or acquired defects of the maxillofacial region. These defects may result from trauma, cancer, or other conditions, impacting speech, chewing, facial appearance, and overall quality of life. The field aims to restore both function and aesthetics, improving patients' well-being.

Aim: To evaluate the functional outcome and Quality of Life (QoL) after prosthetic rehabilitation in patients having maxillofacial defects.

Materials and Methods: An electronic search was carried out across PubMed and Google Scholar to identify relevant articles published up to November 2023. Based on the framework of Population, Intervention, Control, and Outcomes (PICO), the main research question for this study was, "Does prosthetic rehabilitation improve functional outcome and QoL in patients with maxillofacial defects?" By looking at the titles, abstracts, and full texts of the articles, it was possible to verify their relevance and see if they met the inclusion criteria. This systematic review comprised Randomised Controlled Trials (RCTs), cross-sectional studies, retrospective studies, and prospective studies on patients receiving prosthetic rehabilitation for maxillofacial defects published between 1990 and 2023. Only English-language articles were considered. Studies on congenital maxillofacial defects were excluded. A quality assessment of the listed studies was conducted using the Joanna Briggs Institute (JBI) tool.

Results: Out of the 155 results returned by the database search, 128 were removed due to incomplete, inconsistent, or missing information. Three additional papers were removed after evaluating 27 full text papers for eligibility. For that reason, the current systematic review includes a total of 24 papers. Nineteen studies included in this review were on maxillary defects with a total of 798 participants. Three studies addressed mandibular defects with 267 participants, and the remaining two covered facial defects with a total of 93 participants. A quality assessment of studies was done. Meta-analysis was not possible due to diversity of the data.

Conclusion: Individuals with maxillofacial abnormalities experience significantly better functional outcomes and a higher QoL after maxillofacial prosthetic rehabilitation. However, using standardised evaluation instruments is crucial to guarantee consistent results and make it easier to compare results across various cases. By doing this, we can keep enhance patient well-being and more accurately assess the long term effects of prosthetic therapies.

Keywords: Functional rehabilitation, Maxillofacial prosthesis, Quality assessment, Treatment outcomes

INTRODUCTION

Maxillofacial prosthetics is a specialised branch of dentistry that deals with congenital and acquired defects of the maxillofacial region. These defects can be due to traumatic injuries, cancers, or other conditions that affect the appearance, function, and overall well-being of patients. Patients face significant challenges related to speech, mastication, facial aesthetics, and overall QoL. Both surgical and prosthetic rehabilitation play essential roles in addressing post-maxillectomy defects [1]. Surgical techniques directly repair these defects, but certain factors can limit their effectiveness, including patient age, residual tissue availability, tumour monitoring needs, vascular compromise due to radiation, donor site suitability, and patient preferences [2]. When surgical reconstruction faces challenges, prosthetic devices become the preferred treatment. Collaborative teams of specialists work together to provide comprehensive care, incorporating recent advancements in pain management, prosthetic control, evidence-based information, and telehealth services [3,4]. Different maxillofacial prostheses, like palatal obturators, mandibular guide flange, nasal, and auricular prostheses, can be given to patients depending on the type of defect. Functional rehabilitation and QoL after treatment have been especially emphasised in recent years because of awareness and overall improvement in the lifestyle of individuals in developing countries like India [5]. By assessing functional outcomes, we get an idea regarding the effectiveness of different prosthetic designs and interventions. How patients adapt to prosthetic devices can help us to directly understand their QoL. Additionally, understanding patients' perceptions after implant-prosthetic rehabilitation can aid in customising treatment approaches. In conclusion, a systematic review of maxillofacial prosthetics is essential for evidence-based practice, quality assessment, and shaping future research in this field. Thus, this systematic review was conducted to evaluate the functional outcome and QoL after prosthetic rehabilitation in patients with maxillofacial defects.

MATERIALS AND METHODS

This systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist recommendations and was registered with International Prospective Register of Systematic Reviews (PROSPERO) under CRD42019139516.

Primary research question: Does prosthetic rehabilitation improve functional outcomes and QoL in patients with maxillofacial defects?

PICO question

- Patients with maxillofacial defects (P)
- Rehabilitated using different maxillofacial prostheses (I)
- No prosthetic rehabilitation (C)
- Functional outcomes and Quality of Life (QoL) (O)

Inclusion criteria: The research considered for this systematic review comprised pilot studies, RCTs, cross-sectional studies, retrospective studies, and prospective studies on patients with prosthetic rehabilitation for maxillofacial defects published between 1990 and 2023. Only English language articles were considered.

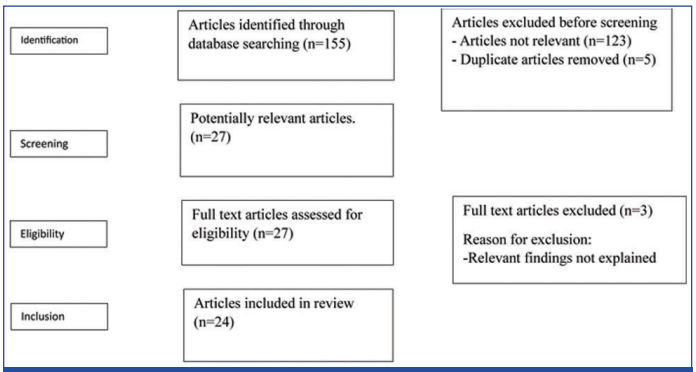
Exclusion criteria: Studies that did not meet all the aforementioned inclusion criteria were excluded. Studies on congenital maxillofacial defects and systematic reviews were also excluded.

Study selection: Studies evaluating the functional outcomes and QoL after prosthetic rehabilitation of maxillofacial defects were included in this review.

Study Procedure

Search strategy: An electronic search was carried out across several databases, including PubMed (93) and Google Scholar (62), to identify relevant articles published up to November 2023. The search was limited to articles written in English. To define the search strategy, a combination of controlled vocabulary (MeSH terms in PubMed) and free text terms from titles and abstracts was used. The search strategies were constructed using keywords corresponding to each section of the PICO question, connected by the Boolean operator OR. Finally, all sections were combined using the Boolean operator AND. Additionally, relevant studies were identified by searching within the references of articles from these journals.

Two review authors (SG, SD) independently read and judged all titles and abstracts of the studies retrieved in the searches for possible inclusion in the review. In case of any discrepancies, a third author (NP) was consulted for clarification [Table/Fig-1].



[Table/Fig-1]: Preferred reporting items for systematic reviews and meta-analyses flowchart.

Search strategy developed for medline:

1. "Oromaxillary defect" (tw) OR "maxillary defect" (tw) OR maxillectomy (tw) OR palatectomy (tw) OR "orofacial cancer" (tw) OR "orofacial tumour" (tw) OR "orofacial tumour (tw) OR "maxillary cancer" (tw) OR "maxillary tumour" (tw) OR "maxillofacial defect" (tw) OR "maxillofacial trauma" (tw) OR "maxillofacial injury" (tw) OR "maxillofacial cancer" (tw) OR "mandibular resection" (tw) OR mandibulectomy (tw) OR "nasal defects" (tw) OR rhinectomy (tw) OR "auricular defects" (tw) OR auriculectomy (tw) OR "ear defects" (tw) OR "orbital defects" (tw) OR "orbital trauma" (tw) OR "ocular trauma" (tw) OR "ocular defects" (tw) OR "eye defects" (tw) OR "midfacial defects" (tw)
2. "Prosthetic rehabilitation" (tw) OR "mandibular guide flange" (tw) OR prosthe (tw) OR "dental prosthesis" (tw) OR "maxillofacial prosthesis" (tw) OR "nasal prosthesis" (tw) OR "auricular prosthesis" (tw) OR "ocular prosthesis" (tw) OR "orbital prosthesis" (tw) OR "midfacial prosthesis" (tw) OR obturator (tw)
3. "Functional outcome" (tw) OR "quality of life" (tw) OR speaking (tw) OR chewing (tw) OR swallowing (tw) OR deglutition (tw) OR respiration (tw) OR breathing (tw) OR phonetic* (tw) OR mastication (tw) OR speech (tw) OR aesthetic (tw) OR appearance (tw)
4. "Clinical trial" (tw) OR "prospective study" (tw) OR "cohort study" (tw) OR "retrospective study" (tw) OR "case-control study" (tw)

Final search query:

#1 AND #2 AND #3 AND #4

Data extraction: In this systematic review, one reviewer (SG) collected information about the included studies, while a second reviewer (SD) independently cross checked the collected data. The data extraction process involved systematically gathering details such as publication information (authors, country, and year), characteristics related to outcomes, study type, sample characteristics (sample size), and outcome measurements (functional outcome and QoL) from each included study.

For each study, all results related to functional outcomes and QoL were included. While some studies assessed only functional outcomes and others only QoL, most evaluated both. No restrictions based on time points or analyses were applied.

Quality assessment of included studies: Two review authors independently assessed the articles. In case of discrepancies, a third author was consulted for clarification. The quality of the included studies was assessed using the JBI tool for analytical cross-sectional studies, cohort studies, RCTs, and quasi-experimental studies. Each question was individually evaluated and assigned scores of 1 for "Yes" and "Not applicable," and 0 for "No" and "Unclear" for each question. The cumulative score assigned to each study was divided by the maximum achievable score: eight for cross-sectional studies, eleven for cohort studies, thirteen for RCTs, and nine for quasi-experimental studies. If the scores ranged from 0 to 0.3, the studies were considered low quality; scores between 0.4 and 0.6 indicated moderate quality, whereas studies with scores between 0.7 and 1.0 were regarded as high quality.

RESULTS

The search strategy acquired 155 articles, of which 123 were not relevant, and five were duplicates. From the remaining 27 articles, three did not explain the relevant information and were excluded. Thus, a total of 24 studies were included in this review. This review consisted of 8 prospective studies, 14 retrospective studies, one RCT, and one non RCT [Table/Fig-2] [6-29]. In the studies reviewed, the most common defects were maxillectomy defects, followed by mandibular resection and other maxillofacial defects. Prosthetic rehabilitation led to improved functional outcomes. Implant supported prostheses demonstrated greater efficiency than conventional prostheses. Flap surgeries showed comparable results to obturator prostheses, with flap surgeries proving superior for extensive defects. Overall, prosthetic rehabilitation positively impacted the QoL, with implant retained prostheses outperforming conventional ones.

The included studies varied in their design, comprising pilot studies, RCTs, cross-sectional studies, retrospective studies, and prospective studies, with sample sizes ranging from 11 to 220. Though most of the studies validated outcome measures, variation was seen in the assessment tools and follow-up duration. The quality analyses indicated that all the studies except one had high quality. The remaining study was of moderate quality. The quality assessment for each study is presented in the [Table/Fig-3-6] for each domain [6-29]. A total of 23 studies were of high quality, and one study was of moderate quality. None of the studies were of low quality. The studies were heterogeneous, as the value of I^2 was high. Thus, a meta-analysis was not possible.

S. No.	Author	Year	Region	Study Design	Age	Sample size	Type of defect	Prosthesis	Functional Outcome	Quality of Life (QoL)
1.	Ogino Y et al., [6]	2021	Fukuoka, Japan	Cross-sectional retrospective study	20 years and above	47	Maxillectomy	Obturators	Significant improvements were seen in tongue functioning. Swallowing function was improved by prosthetic intervention using obturator prostheses.	Not reported
2.	Wu S et al., [7]	2018	Guangzhou, China	Non Randomised Controlled Trial (RCT)	18 years and above	34	Maxillectomy	Obturators	Patients' Speech Intelligibility (SI) improved significantly as nasalisation of i and/or u decreased. Those with obturators had higher F2 formant frequencies for all six vowels, closer to normal controls, compared to patients without obturators.	Not reported
3.	Chigurupati R et al., [8]	2013	San Francisco, California	Retrospective Cross-sectional, Pilot study	14 to 84 years	23/25 responded	Maxillectomy	Obturators	Not reported	Individuals who had a malfunctioning obturator showed considerable psychological distress. As obturator function improved, QoL increased. For patients undergoing maxillectomy and prosthetic obturator reconstruction, radiation therapy was the factor that had the biggest impact on QoL.
4.	Chen C et al., [9]	2015	China	Cohort study	47 to 81 years	28	Maxillectomy	Obturators	Obturator prostheses improve oral function in patients with maxillary abnormalities. Those with stud-attached obturators perform better in speech and swallowing compared to those with conventional or magnetic-retentive prostheses.	Not reported
5.	Grover R et al., [10]	2021	Northern India	Non randomised controlled study.	18 to 71 years	48	Maxillectomy	Obturators	Patients wearing tailored obturators showed improvements in swallowing performance, reduced nasal resonance, and SI.	Not reported
6.	Nemli SK et al., [11]	2013	Ankara, Turkey	Retrospective and Prospective Study	15 to 77 yrs and 14 to 75 yrs	54 and 28	Auricular defect, Orbital defect, Nasal defect	Implant retained prosthesis	Not Reported	Implants showed a positive impact on patient satisfaction with appearance, ease of usage, and self-consciousness in addition to improving retention. Patients with maxillofacial abnormalities had a good QoL with implant-retained prostheses, which were deemed highly satisfying.
7.	Mittal M et al., [12]	2017	Jalandhar Cantt, Punjab; India	Prospective study	32 to 78 years	30	Maxillary defects	Obturators	Chewing and eating, voice clarity in public and on the phone, swallowing food and liquids, word pronunciation, and social interaction all showed a statistically significant improvement. Magnet retention produced the best results, followed by the cast partial group. The group with traditional obturators had the least favourable result.	Not reported

8.	Seignemartin CP et al., [13]	2015	FOSP; S~aoPaulo, Brazil	Retrospective cross-sectional study	18 years and above	73	Maxillectomy	Obturators	The patients' total (Obturator Functioning Scale) OFS score was good. Individuals with Class 2b or below defects performed better with obturators. Patients with lower obturator performance were those who reported limitations on eating in public and speech understanding.	Overall, QoL assessments during obturator prosthesis rehabilitation were favourable. Partial removable prostheses scored higher than complete dentures. QoL was lower in patients who underwent postoperative radiation, and those with Class 2b or smaller defects had higher scores. Patients with low QoL often reported eating in public with limitations and difficulty understanding speech.
9.	Lethaus B et al., [14]	2009	Nijmegen, The Netherlands	Retrospective study	48 to 92 years	11	Maxillectomy	Obturator	OFS results show minimal difficulties with eating, speaking, and other activities. Severe leakage occurred in 18% of patients, 27% reported mild nasal speech, and 36% experienced dry mouth.	Not reported
10.	Vijayabharathi P et al., [15]	2021	India	Prospective clinical study	19 to 65 years	14	Maxillectomy	Obturator	Not Reported	Following maxillectomy, QoL and psychological status (PS) often decline. However, obturator rehabilitation can improve both, likely due to better soft tissue health and restored oral function. A functional definitive obturator, combined with patient education, counseling, and information about the procedure, prosthetic rehabilitation, and expected outcomes, plays a crucial role in enhancing QoL and PS in maxillectomy patients.
11.	Koga S et al., [16]	2020	Fukuoka, Japan	Retrospective Study	64 to 76 years	25	Maxillary defects	Obturator	Not reported	Following maxillofacial prosthesis treatment, Oral Health-Related Quality of Life improved. Occlusal units and age were associated with higher OHRQoL. Regardless of the characteristics of the patient, oral hygiene education and treatment could enhance the patient's oral hygiene.
12.	Rieger J et al., [17]	2002	Edmonton, Canada.	Prospective study	15 to 74 years	12	Maxillectomy	Obturator	With a maxillary obturator, speech can be effectively restored to its preoperative level. The intelligibility results showed that word intelligibility was lowest in the absence of an obturator and highest prior to surgery. Word intelligibility scores with an obturator fell in between the results attained at the other two occasions.	Not Reported
13.	Artopoulou II et al., [18]	2017	Athens, Greece.	Retrospective, Cross-sectional Study	40 years and above	57	Maxillectomy	Obturator	Regardless of the extent of the maxillectomy defect, obturator prostheses can return patients to a satisfactory degree of rehabilitation and produce favourable functional and aesthetic outcomes.	A well-functioning obturator prosthesis can significantly enhance QoL. Adjuvant therapies lead to notable improvements in both functional and psychosocial aspects, greatly impacting QoL and obturator performance.

14.	Jiang F-F et al., [19]	2015	China	Retrospective study	42 to 70 years	18	Maxillectomy	Obturator {Computer-Aided Design /Computer-Aided Manufacturing (CAD/CAM)} prosthesis)	Eating, swallowing, and speech intelligibility significantly enhanced.	CAD/CAM prosthesis improves the QoL.
15.	Qu XZ et al., [20]	2016	Shanghai, China	Retrospective study	39 to 70 years	10	Maxillectomy	Zygoma implant-supported prosthesis	Following implant installation, there was a reported significant improvement in routine masticatory function.	Not reported
16.	Kumar L et al., [21]	2023	Lucknow, India	Prospective cohort study	18 to 50 years	20	Maxillectomy	Zygomatic Implant retained/ supported prosthesis	After receiving a zygomatic implant-supported prosthesis, patients experience less tension and anxiety. Masticatory performance improves with implant-supported obturators compared to traditional prostheses. Rehabilitation results in reduced nasal air escape, less nasality, fewer consonant imprecisions, and better overall intelligibility.	Not reported
17.	Rieger JM et al., [22]	2011	Edmonton, AB, Canada.	Retrospective study	21 to 79 years	59	Maxillectomy	Obturators	When maxillary abnormalities are treated surgically or with prosthetic intervention, similar cosmetic and speech outcomes can be achieved.	Not reported
18.	Moreno MA et al., [23]	2009	Houston, Texas.	Retrospective study	9 to 88 years	113	Maxillectomy	Obturator	There was no difference in speech intelligibility or postoperative diet between the obturator and free flap groups. However, for significant (>50%) palatal abnormalities, free flap repair was superior.	Not reported
19.	Saracoglu K et al., [24]	2017	Istanbul, Turkey	Prospective study	49 to 81 years	22	Marginal mandibulectomy	Implant-retained overdentures and fixed metal-acrylic resin prostheses.	The aesthetic and functional results met expectations. Because fixed restorations resemble natural teeth, they were more widely accepted.	Patients with marginal mandibulectomies had improved oral health-related QoL due to implant-retained overdentures and fixed metal-acrylic resin prostheses.
20.	Kumar VV et al., [25]	2016	Bangalore, India	Prospective randomised clinical study	Avg.34 years	25/25	Reconstructed mandible (free fibula flap)	Implant supported overdentures	Not reported	Patients with restored mandibles report better QoL with implant-supported removable overdentures. QoL outcomes were similar in patients with detachable prostheses supported by two or four implants.
21.	Wang L-M et al., [26]	2022	China	Retrospective study		116	Maxillectomy	Obturator	Chewing efficiency was superior with conventional obturators than pedicled Submental Artery Island Flap (SAIF).	SAIF group reported statistically and clinically significant higher overall QOL scores when compared with those in the conventional obturator prosthesis group.
22	Sandner A et al., [27]	2009	Germany	Retrospective study	43 to 84 years	11	Rhinectomy	Implant retained nasal prosthesis	Not Reported	Patient perceptions of QOL show improvement when prostheses are retained by subperiosteal implants.
23	Teoh KH et al., [28]	2005	New York	Retrospective study	1 to 90 years	220	Mandibular resection	Prosthetic intervention	Following mandibular repair, individuals who underwent prosthetic intervention saw considerably better functional outcomes than those who did not.	Not reported

24	Aladashi OQS et al., [29]	2021	Cairo	Randomised clinical trial	31 to 71 years	60	Partial maxillectomy	Obturator	Compared to submental island flap, masticatory function scores were significantly greater in the obturator group. Additionally, the obturator group's look improved more.	Submental flap repair provided a higher QoL than obturator prostheses. flap reconstruction improved speech, chewing, swallowing, and psychosocial adjustment.

[Table/Fig-2]: Illustrates the 24 included studies [6-29].

Study	Were the inclusion criteria for the sample clearly defined?	Were the study participants and setting described in detail?	Was the exposure measured in an appropriate and reliable manner?	Were objective, standardised criteria utilised to assess the condition?	Were any confounding factors identified?	Were measures for dealing with confounding factors specified?	Were the outcomes measured in a reliable and accurate manner?	Was a proper statistical analysis implemented?	Score	Quality
Ogino Y et al., 2021[6]	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	7/8=0.8	High
Chigurupati R et al., 2013 [8]	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6/8=0.7	High
Seignemartin CP et al., 2015 [13]	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6/8=0.7	High
Koga S et al., 2020 [16]	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6/8=0.7	High
Artopoulou II et al., 2017 [18]	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6/8=0.7	High
Jiang F et al., 2015[19]	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6/8=0.7	High
Rieger JM et al., 2011 [22]	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6/8=0.7	High
Moreno MA et al., 2010 [23]	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6/8=0.7	High

[Table/Fig-3]: Quality assessment of cross-sectional studies using JBI tool for analytical cross-sectional studies [6,8,13,16,18,19,22,23].

DISCUSSION

Maxillofacial defects arising from developmental anomalies, trauma, or ablative cancer surgeries pose significant challenges. These alterations in form, function, and aesthetics can deeply impact an individual. The face, often considered a reflection of personality and existence, undergoes changes due to these defects. Such alterations may affect self-confidence, self-worth, and the ability to interact with peers, thus impacting the overall QoL. Treatment modalities like conventional maxillofacial prostheses, implant-supported prostheses, and flap surgeries are available for the rehabilitation of these defects [30]. However, the evidence regarding these treatment modalities has been inconclusive. There are systematic reviews in the literature about outcome of maxillectomy defects, including surgical reconstruction and reconstruction using implants [31-34].

The systematic review conducted by König J et al., concluded that obturator devices and surgical reconstruction have similar effects on QoL and health outcomes in maxillectomy patients [32]. However, Sharaf MY et al., stated that surgical rehabilitation proved to be better compared to prosthetic rehabilitation. But obturator prostheses have been shown to be effective in the immediate post-surgical period and serve as a good alternative when the surgical obturation is compromised [33]. Wijbenga JG et al., concluded that oral rehabilitation with implant-supported dental prostheses after reconstruction of segmental maxillofacial defects with Vascularised Free Fibula Flaps (VFFF) resulted in good to excellent speech intelligibility and aesthetics [34]. However, the present review contains all types of maxillofacial defects and synthesises the evidence regarding their impact on QoL as well as functional outcomes.

The present systematic review consisted of eight prospective studies [9,10,12,15,17,21,24,25], 14 retrospective studies [6,8,11,13-14,16,18-20,22-23,26-28], one RCT [29], and one non RCT [7]. Among these studies, 18 reported the functional outcome whereas only 12 reported the QoL [8,11,13,15,16,18,19,24-27,29]. This review covers studies of both intraoral as well extraoral maxillofacial defects. Nineteen studies included in this review were on maxillary defects [9,10,12-18,21,23-27,29]. Three studies addressed mandibular defects [19,20,28], while the remaining two covered facial defects [11,22]. The treatment modality used in 17 studies was based on conventional prostheses. Functional outcome and QoL of implant-retained prostheses have been reported in six articles, from which two studies were done on zygomatic implants. Only one study is on CAD/CAM prostheses. A comparative study between prosthetic and surgical rehabilitation was done in three articles.

These studies revealed that obturator prostheses proved to be beneficial in improving the functional outcome of patients with maxillary defects. Retrospective studies have suggested that obturator improves the speech intelligibility and swallowing function. Also helps attaining acceptable aesthetics. Zygomatic implants showed better results than conventional prostheses in restoring the functions of patients. Prospective studies show a moderate and statistically significant improvement in chewing/eating, public/phone voice intelligibility, swallowing of foods and liquids, word pronunciation, and social engagement after prosthetic rehabilitation. Zygomatic implant-retained obturator significantly decreased open nasality, nasal air escape, consonant imprecision, and increased overall intelligibility after rehabilitation.

Free flap and Submental Artery Island Flap (SAIF) surgeries are reconstructive procedures also used in treating a maxillofacial defects. They had comparable results to that of conventional obturator prostheses. Patients who underwent prosthetic intervention following mandibular reconstruction had much better functional outcomes than those who did not receive this intervention. Patients without prosthetic rehabilitation faced difficulties in swallowing and speech, which negatively affected their overall QoL. Thus, it can be concluded that overall, prosthetic rehabilitation thus improves the functional outcome of patients with maxillofacial defects.

Study	Were the two groups comparable and drawn from the same population?	Were the exposures measured identically to assign participants to the exposed and unexposed groups?	Was the exposure measured in an appropriate and reliable manner?	Were any confounding factors identified?	Were measures for dealing with confounding factors specified?	Were the groups/ participants free of the outcome at the beginning of the study (or at the time of exposure)?	Were the outcomes measured in a reliable and accurate manner?	Was the follow-up period reported to be lengthy enough for outcomes to occur?	Was follow-up completed, and if not, were the reasons for failure to follow up disclosed and investigated?	Were measures for addressing incomplete follow-up used?	Was a proper statistical analysis implemented?	Score	Quality
Chen C et al., 2015 [9]	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	9/11=0.8	High
Nemli SK et al., 2013 [11]	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	9/11=0.8	High
Rieger J et al., 2002 [17]	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	9/11=0.8	High
Sandner A et al., 2009 [27]	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	8/11=0.7	High
Teoh KH et al., 2005 [28]	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	10/11=0.9	High
Mittal M et al., 2017 [12]	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	9/11=0.8	High
Wang L-M et al., [26]	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	9/11	High

[Table/Fig-4]: Quality assessment of cohort studies using JBI tool for cohort studies [9,11,12,17,26-28].

Study	Was true randomisation used for assignment of participants to treatment groups?	Was allocation to treatment groups concealed?	Were treatment groups similar at the baseline?	Were participants blind to treatment assignment?	Were those delivering treatment blind to treatment assignment?	Were outcomes assessors blind to treatment assignment?	Were treatment groups treated identically other than the intervention of interest?	Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analysed?	Were participants analysed in the groups to which they were randomised?	Were outcomes measured in the same way for treatment groups?	Were outcomes measured in a reliable way?	Was appropriate statistical analysis used?	Was the trial design appropriate, and any deviations from the standard RCT design (individual randomisation, parallel groups) accounted for in the conduct and analysis of the trial?	Score	Quality
Kumar VV et al., 2016 [25]	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11/13=0.8	High
Aladashi OQS et al., 2020 [29]	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11/13=0.8	High

[Table/Fig-5]: Quality assessment of Randomised Controlled Trials (RCT) using the JBI tool for RCT studies [25,29].

Study	Is it clear in the study what is the "cause" and what is the "effect" (i.e. there is no confusion about which variable comes first)?	Was there a control group?	Were participants included in any comparisons similar?	Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	Were there multiple measurements of the outcome, both pre and post the intervention/ exposure?	Were the outcomes of participants included in any comparisons measured in the same way?	Were outcomes measured in a reliable way?	Was follow-up complete and if not, were differences between groups in terms of their follow-up adequately described and analysed?	Was appropriate statistical analysis used?	Score	Quality
Grover R et al., 2021 [10]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9/9=1.0	High
Vijayabharathi P et al., 2021 [15]	Yes	No	Yes	NA	Yes	NA	Yes	Yes	Yes	8/9=0.8	High

Qu XZ et al., 2016 [20]	Yes	No	Yes	NA	Yes	NA	Yes	Yes	Yes	8/9=0.8	High
Wu S et al., 2018 [7]	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	8/9=0.8	High
Lethaus B et al., 2009 [14]	Yes	No	Yes	NA	No	NA	Yes	Yes	No	6/9=0.6	Moderate
Kumar L et al., 2023 [21]	Yes	No	Yes	NA	Yes	Yes	Yes	Yes	Yes	8/9=0.8	High
Saracoglu K et al., 2017 [24]	Yes	No	Yes	NA	No	Yes	Yes	Yes	Yes	7/9=0.7	High

[Table/Fig-6]: Quality assessment of non-Randomised Controlled Trials (RCT) using JBI tool [7,10,14,15,20,21,24].

Patients with poorly functioning obturator experienced severe psychological anguish. QoL improved when the obturator function improved. Implants not only enhanced retention but also increased patient satisfaction with look, simplicity of use, and reduced self-consciousness. Implant-retained prosthesis was rated highly satisfactory, indicating good QoL for individuals with craniofacial abnormalities. Partial removable prostheses got a higher QoL score than complete denture prostheses. Patients who received postoperative radiation had a lower QoL score. Providing sufficient information, education, and counseling for patients concerning the operation and its repercussions, prosthetic rehabilitation, and the outcome of the rehabilitation, as well as ensuring a well-functioning prosthesis, all contribute to improved QoL.

The quality of studies included in this review ranged from moderate to high. The tool used for quality assessment of these studies was the JBI tool for analytical cross-sectional studies, cohort studies, RCT studies, and the JBI tool for quasi-experimental studies. The heterogeneity in study designs precludes a meta-analysis due to lack of comparability across studies. Thus, no meta-analysis steps involving statistical methods to explore differences and combine their effects. The results are summarised for comparison based on the individual study results. Eighteen studies reported functional outcomes, of which six were prospective. Fifteen studies were of high quality and one study was of moderate quality. Only Ogino Y et al., and Teoh KH et al., identified confounding factors, but no adjustments were made [6,28].

Limitation(s)

The limitations identified in the systematic review highlight critical gaps in the current research. There is a lack of reporting on functional outcomes, such as speech intelligibility, chewing efficiency, and swallowing ability in some studies, which limits a comprehensive understanding of rehabilitation effectiveness. Additionally, there is limited research on the rehabilitation of defects beyond obturators, suggesting the need for a broader exploration of diverse rehabilitation techniques. Furthermore, the absence of standardised assessment tools complicates cross-study comparisons, making it challenging to draw reliable conclusions. Addressing these issues through more detailed functional reporting, diversifying rehabilitation research, and adopting universal assessment tools would significantly enhance the quality and applicability of future studies.

CONCLUSION(S)

In conclusion, maxillofacial prosthetic rehabilitation significantly enhances both functional outcomes and the QoL of patients with maxillofacial defects. However, to ensure consistent outcomes and facilitate comparison across different cases, it is essential to employ standardised assessment tools. By doing so, the long-term impact of prosthetic interventions could be evaluated, and continue to improve patient well-being.

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