Journal of Chemical Health Risks

www.jchr.org

JCHR (2025) 15(5), 3077-3081 | ISSN:2251-6727

Retentive Aids in Maxillofacial Prosthodontics: A Comprehensive Review

Dr. Vivekanand Tapare[1], Dr. Gaurav Beohar[2], Dr. Prince Kumar[3], Dr. Nilesh Fatale[4], Dr. Darshana Raut[5], Dr. Nitin Nawale[6]

[1]Post Graduate Student, Department of Prosthodontics and Crown & Bridge, Bhabha College of Dental Sciences, Bhopal, MP, India (Corresponding Author)

[2]Professor and Head of the Department, Department of Prosthodontics and Crown & Bridge, Bhabha College of Dental Sciences, Bhopal, MP, India

[3]Professor, Department of Prosthodontics and Crown & Bridge, Bhabha College of Dental Sciences, Bhopal, MP, India

[4]Post Graduate Student, Department of Prosthodontics and Crown & Bridge, Bhabha College of Dental Sciences, Bhopal, MP, India

[5]Post Graduate Student, Department of Prosthodontics and Crown & Bridge, Bhabha College of Dental Sciences, Bhopal, MP, India

[6]Post Graduate Student, Department of Prosthodontics and Crown & Bridge, Bhabha College of Dental Sciences, Bhopal, MP, India

Corresponding Author: Dr. Vivekanand Tapare

(Received: 27 September 2025 Revised: 05 October 2025 Accepted: 14 October 2025)

KEYWORDS

Intraoral Prosthesis, Extraoral Prosthesis, Implants, Magnets, Adhesives

ABSTRACT:

Maxillofacial prostheses are artificial substitutes used to restore form and function in patients with maxillofacial defects. Retention is a critical factor in the success of maxillofacial prostheses. The stability and functionality of these prostheses can be enhanced by using retentive aids. tics. Increased retention improves comfort as well as the confidence in the patient while wearing a facial prosthesis at work and in social settings The challenges posed by varying defect sizes, tissue quality, patient factors, and aesthetics make the selection of appropriate retentive aids complex. This review summarizes the types of retentive aids (anatomic, mechanical, chemical, surgical/implant-based), their technical features, clinical applications, advantages, limitations, recent advances, and future directions. Evidence from literature up to 2024 is synthesized to aid practitioners in decision-making.

Introduction

Maxillofacial prosthetics involves replacing or restoring parts of the face or jaws which are lost or deformed due to oncologic resection, congenital anomalies, trauma, or disease. Prostheses such as obturators, auricular, nasal, orbital, or large facial prostheses serve not only to restore function (speech, mastication, swallowing and breathing) but also appearance and psychological well-being. Among the many factors that determine the success of such prostheses, retention (i.e., the ability of the prosthesis to remain stable and resist dislodging forces during function) is of paramount importance. Poor retention leads to discomfort, embarrassment, reduced usage, compromised hygiene, and reduced patient satisfaction. Multiple retentive aids have been proposed and used over decades. These include anatomical undercuts, mechanical devices (clips, spectacles, springs, etc.), chemical adhesives, implant or surgical anchorages. The right choice depends on defect type/location, tissue condition, patient factors (dexterity, cost), aesthetic requirements, and long-term maintenance. This review consolidates evidence from recent literature on retentive aids in maxillofacial prosthodontics, focusing on technical considerations, clinical outcomes, and future trends.

Classification of Retentive Aids

Based on recent reviews and literature (e.g., Shah et al. 2024) the retentive aids can be grouped broadly into:

Anatomic (or Anatomical) Retention: Using natural undercuts, residual bony and soft tissue contours, scar bands, septal structures, etc. Extraoral (facial) or intraoral.

Mechanical Retention: Devices that use physical means: bars and clips, precision attachments, spectacles frames, springs, snap attachments, etc.

Journal of Chemical Health Risks

www.jchr.org

JCHR (2025) 15(5), 3077-3081 | ISSN:2251-6727

Chemical Retention: Adhesives/skin glues/medical-grade adhesives used to bond prosthesis margins to skin.

Surgical/Implant Retention: Use of osseointegrated implants, craniofacial anchorage, extraoral implants, abutment systems, etc.

Hybrid/Combined Systems: Combinations of the above (e.g., anatomical+adhesives; implants+magnets; mechanical+adhesive) to optimize retention in challenging defects.
(Shah et al. (2024) technical considerations etc) offers this classification. (Science and Education Publishing)

Recent Advances and Digital Technology

CAD/CAM & 3D Printing: Allow for the precise fabrication of prostheses and retentive components that fit complex anatomical structures, improving fit and esthetics. Artificial Intelligence (AI): AI-driven systems are enhancing treatment planning, anatomical replication, and custom-fit prosthesis design, facilitating better prediction of retention and esthetics. Patient-Specific Implants (PSI): Custom digital workflows enable the creation of individualized implants providing superior retention, especially in challenging reconstructive cases.

Detailed Description of Types

1. Anatomic Retention

Undercuts: Natural indentations or concavities in bone or soft tissue which a prosthesis can engage to "hook under". In intraoral obturators, residual alveolar ridges, palatal vaults, retromolar areas etc. In extraoral prostheses, the infraorbital rim, nasal apertures, eyelid folds, glabella, etc. (aprd.in)

Soft Tissue Contours/Scar Bands/Septa: In nasal or orbital prostheses, septal cartilage, residual nasal septum, folds under ala or eyelids can be used. But soft tissue is mobile, tolerates less load, can be distorted, susceptible to movement. (Science and Education Publishing)

Advantages: Non-invasive, cost-effective, no surgery or foreign bodies, patient comfort often higher.

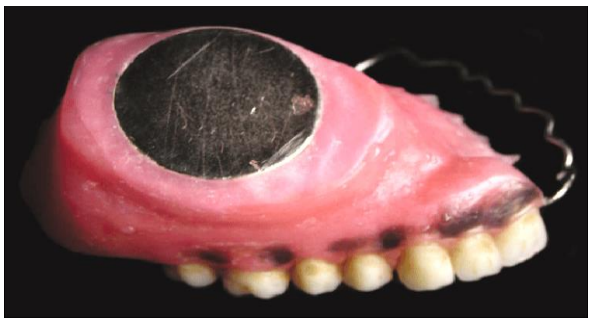
Drawbacks: Undercuts may be insufficient; over-extension into undercut may irritate tissue; soft tissue mobility reduces predictability; for large defects anatomical retention may be inadequate.

2. Mechanical Retention

Clips, Bars, Precision Attachments: For example bar-clip systems over implants or abutments; precision attachments connecting extraoral prosthesis (e.g., nasal) to spectacle frames or removable frameworks. (mendeley.com)

Spectacle Frames: Prosthesis is clipped/attached to eyeglass frames; especially useful for nasal, orbital prostheses. Allows easier removal/placement; aesthetic issues need consideration. (Science Scholar)

Magnets: Small size, passive, allow for easy removal; have been widely used intra- and extra-orally. Types: rare-earth magnets, e.g., samarium-cobalt (Sm-Co), neodymium, or cobalt-based; coatings to prevent corrosion. (PubMed)



Special Devices/Springs/Snap Attachments: For example springs engaging septal cartilage, or snap/clasp designs anchored to remaining teeth or prosthetic superstructure. (Science and Education Publishing)

Advantages: More retention than anatomical alone; can be designed for predictable insertion/removal; certain systems allow for modularity.

Journal of Chemical Health Risks

www.jchr.org

JCHR (2025) 15(5), 3077-3081 | ISSN:2251-6727

Limitations: Bulk; visibility; cost; technical complexity; maintenance; risk of wear or loosening; possible irritation at attachment points; increased hygiene demands.

3. Chemical Retention (Adhesives)

Adhesive pastes, tapes, powders, resins applied to prosthesis periphery, skin surfaces; designed to adhere the margins of extraoral prosthesis to skin. (aprd.in) Key properties: biocompatibility, skin tolerant (non-irritant), able to retain the prosthesis for hours, ease of removal, minimal residue.

Advantages: Allows for marginal invisibility, minimal hardware; often more affordable; easy to adjust; good for small to moderate defects or in patients unwilling for surgery.

Disadvantages: Adhesive strength can degrade with perspiration, oily skin, movements; skin irritation; hygiene challenges; frequent reapplication; adhesive may alter appearance (shine, visible edges).

4. Implant/Surgical Retention

Use of osseointegrated craniofacial implants (in zygomatic, mastoid, orbital rim, glabellar, nasal bones etc.) as anchor points. A variety of attachments possible: bar-clip, ball/button, magnets, custom abutments.

Survival rates: literature suggests auricular prostheses have highest implant survival; nasal and orbital slightly less. Long-term outcomes good when implants integrate and are placed in suitable bone quality.

Advantages: Most reliable retention; allows for larger prostheses with minimal adhesives; better patient satisfaction; possibly less visibility of external hardware.

Challenges: Surgical morbidity; cost; anatomical constraints (bone volume, radiation damage); maintenance of implants (peri-implant hygiene); possible implant failure.

Technical Considerations & Decision Factors

From recent literature, especially technical reviews (e.g., Shah et al., 2024) the following factors should be considered when selecting and implementing retentive aids:

- **Defect Size, Location, and Tissue Type**: e.g., soft tissue mobility, skin type (dry, oily, flaky), bone availability. (Science and Education Publishing)
- **Patient Factors**: Manual dexterity, cost constraints, comfort, cosmetic expectations, willingness for implant surgery. (Science and Education Publishing)
- **Prosthesis Design**: Thickness, weight, margin design, edge blending; removal/insertion path; proportion of prosthetic support vs retention. Lightweight materials help. (Science and Education Publishing)
- **Material Compatibility**: Especially with adhesives (skin contact sensitivity, allergic reactions), with magnets (corrosion, biocompatibility), with implant abutments (material strength, coatings). (PubMed)
- **Hygiene and Maintenance**: Ease of cleaning both prosthesis and retentive elements; durability; replacement cycles. (Science and Education Publishing)
- **Aesthetic Considerations**: Visibility of attachments, line of prosthesis margins, color matching, reduction of shine or glare from adhesives or hardware. (aprd.in)

Evidence from Literature

The review "Maxillofacial prosthetic rehabilitation using different retention systems" (Raghavan, Shajahan & Mathew, 2022) detailed that anatomical, mechanical, chemical, and surgical anchorages are all viable depending on clinical scenario, with implants showing superior patient satisfaction in many cases. Shah et al. (2024) reviewed technical considerations associated with mechanical and chemical retentive aids, noting that though adhesives and mechanical aids are more

Journal of Chemical Health Risks

www.jchr.org

JCHR (2025) 15(5), 3077-3081 | ISSN:2251-6727

frequently used, implant retention is becoming more common due to improved survival rates and patient outcomes. Nazar et al. (2021) article "Retention in maxillofacial prosthetics: A review" emphasizes the role of new materials, rapid prototyping (digital workflows), and combination retention methods (e.g., adhesives plus mechanical) as recent trends. A specific case report: "Customized Thermoplast Retentive Aid for Partial Auricular Prosthesis" (Indu Raj, Syed & Joy, 2023) demonstrates a mechanical/anatomic hybrid aid using thermoplastic material to augment retention when implants are not feasible. This shows innovation in low-resource or patient-constrained settings. The "Prosthetic journey of magnets: a review" article provides detailed history and recent developments of magnet use (e.g. newer coatings, corrosion resistant types, increased biological compatibility), showing magnets are still relevant and evolving.

Advantages & Limitations: Summary

Retentive Aid	Key Advantages	Key Limitations
Anatomic undercuts	Non-invasive; low cost; comfortable	Unpredictability; limited retention in large defects; tissue distortion; may require careful margin design
Mechanical (clips, precision attachments, spectacle frame, springs)	More retention; modular; sometimes easier removal; better control of insertion/removal path	Bulk; cost; visibility; technical complexity; maintenance; wear/loosening
Magnets	Compact; easy to use; good retention with combination aids; low patient effort	Corrosion; loss of magnetism; need protective coatings; cost; strength may decay; alignment issues
Adhesives	Minimal hardware; cosmetic; adjustable; low invasiveness	Skin irritation; variable retention; need frequent reapplication; hygiene; effect of sweating, skin condition; edges visible or lifted
Implant retention	Best stable retention; support large/higher prostheses; high patient satisfaction	Surgical cost & morbidity; need sufficient bone; infection risk; maintenance; possible implant failure; not always feasible (e.g. irradiation)

Recent Advances & Trends

- **Digital workflows/Rapid Prototyping / 3D Design** of prostheses allowing precise margin design, reduced weight, better fit, custom attachment sites. In mechanical and implant retention, virtual planning helps choose optimal implant positions and attachments. (mendeley.com)
- **Improved Adhesive Materials**: New bio-adhesives, more skin-friendly, longer lasting adhesives with improved adhesion even in moisture; better skin bonding and less irritation. (Science and Education Publishing)
- **Magnet improvements**: Better magnets with improved corrosion resistance, coatings (e.g. titanium, stainless), smaller size with comparable pull forces. (PubMed)
- **Innovations in Mechanical Aids**: Thermoplast aids (e.g., customized thermoplastic retention for auricular prosthesis) for economical and less invasive solutions. (Int. J. of Advanced Research)
- **Greater Use of Implants in Extraoral Sites**: For auricular, nasal prostheses; better surgical planning, improved implant geometry; better reported survival (especially auricular). (aprd.in)

Clinical Guidelines/Decision Workflow

Based on reviewed literature, a suggested stepwise approach for choosing a retentive aid is:

1. **Initial Assessment** of defect: size, location, soft tissue quality, bone available, undercuts, skin condition, patient health (including previous irradiation), and expectations (aesthetics, removal/insertion frequency).
2. **Prioritize Anatomical Retention** where possible: plan surgical margins to retain undercuts; preserve

Journal of Chemical Health Risks

www.jchr.org

JCHR (2025) 15(5), 3077-3081 | ISSN:2251-6727

tissue structure during resection where feasible for future retention.

3. **Consider Mechanical Aids** when anatomical retention is inadequate: use of attachments, magnets, spectacle frames, customized frameworks; balance retention vs bulk and visibility.
4. **Evaluate Adhesive Usage**: particularly in facial prostheses, especially when attachments or implants are not feasible or are contraindicated; ensure skin-friendly adhesives, proper care instructions, margin management.
5. **Assess Implant Feasibility**: bone quality/quantity, patient health, cost, surgical risk; plan implant positions carefully; consider long-term maintenance.
6. **Hybrid Approaches**: combine aids for better overall retention; for example, small implants + adhesives; anatomical undercuts + mechanical attachments.
7. **Design and Material Selection**: aim for lightweight prostheses, smooth margins, color matching, durability. Plan insertion path; consider patient's manual ability for putting/removing prosthesis.
8. **Maintenance and follow-up**: educate patient on cleaning prosthesis and retention device; monitor for tissue changes; adjust adhesives or attachments as required; inspect implants for signs of failure.

Gaps & Areas for Future Research

- There is a relative paucity of High-Quality Randomized Clinical Trials comparing different retentive aids (e.g., adhesives vs implant-retained vs magnet-retained) in terms of patient satisfaction, retention over time, costs and complications.
- Long-term studies of newer adhesives and magnet materials under varied environmental conditions (sweat, humidity, skin types).
- Studies on retention in irradiated tissue (where healing and bone quality are compromised).
- More innovation in low cost mechanical retention aids for settings where implants or expensive hardware are not feasible.
- Use of predictive modelling (finite element analysis) to simulate prosthesis retention, stress distribution at margins, to help in design optimization.
- Integration of sensor technology to monitor prosthesis displacement or retention failure in daily life.

Conclusion

Retention is a cornerstone of successful maxillofacial prosthetic rehabilitation. No single retentive aid is universally ideal; selection must be individualized based on the patient, defect, tissues, resources, and aesthetic demands. Recent advances in adhesives, magnet technology, implant retention, and digital workflows provide more options than ever before. Hybrid strategies often yield the best outcomes, balancing retention with patient comfort, aesthetics, and cost. Nonetheless, more rigorous comparative research and innovations for low-resource settings are still needed.

References

1. Shah SA, Yunus N, Gaba N, Rathi N. Technical Considerations Associated with Mechanical and Chemical Retentive Aids in Maxillofacial Prosthodontic Rehabilitation: A Review. Am J Med Case Rep. 2024;12(7):103-109.
2. Mathew RS, Raghavan R, Shajahan PA. Maxillofacial prosthetic rehabilitation using different retention systems: A review. IP Ann Prosthodont Restor Dent. 2022;8(3):143-149.
3. Nazar SA, Nair VV, Kumar H, et al. Retention in maxillofacial prosthetics: A review. Int J Appl Dent Sci. 2021;7(2):568-573.
4. "Prosthetic journey of magnets: a review." PubMed / Journal of Medicine & Life.
5. Indu Raj, Femitha Syed, Tony Joy. Customized Thermoplast Retentive Aid for Partial Auricular Prosthesis – A Case Report. Int J of Adv Res. 2023. (Int. J. of Advanced Research)
6. Raghavan R., Shajahan P.A., Mathew R.S. Maxillofacial prosthetic rehabilitation using different retention systems: A review. IP Annals of Prosthodontics and Restorative Dentistry. 2025 Jul;9(3):135-141.
7. IP Ann Prosthodont Restor Dent. Retention of maxillofacial prosthesis: A review (Kirtika et al., 2023).
8. IP Ann Prosthodont Restor Dent. Retentive aids in maxillofacial prosthesis: A review (Saini et al., 2019). (ipinnovative.com)