EVIDENCE-BASED PROSTHODONTICS: AN INTEGRATED REVIEW OF CLINICAL EVIDENCE AND CONTEMPORARY ADVANCES.

Abstract

Evidence-based prosthodontics (EBP) integrates the best available scientific evidence with clinical expertise and patient values. Prosthodontics contains a mixture of long-established clinical procedures, techniques supported by varying levels of evidence, and rapidly developing technologies. A critical evidence-based approach is therefore required to distinguish established clinical benefit from tradition, laboratory evidence and technological enthusiasm.[1,2]

This narrative review presents a broad, clinically oriented synthesis of evidence across complete dentures, removable partial dentures, fixed prosthodontics, occlusion, temporomandibular disorders, implant prosthodontics, implant overdentures, full-arch rehabilitation, peri-implant health, bone augmentation, contemporary biomaterials, CAD/CAM, digital dentures, additive manufacturing, artificial intelligence, patient-reported outcomes and maintenance. The McGill Consensus of 2002 and York Consensus of 2009 are discussed as important milestones within implant prosthodontics rather than as the central theme of EBP.[3,4,5]

Current evidence supports two-implant mandibular overdentures as a highly effective option for many edentulous patients, while treatment must remain individualized. Contemporary ceramics and digital workflows provide predictable options in selected indications, although long-term comparative evidence is less mature for several newer technologies. Evidence-based prosthodontics therefore means choosing the most appropriate treatment after balancing evidence quality, clinical applicability, biological and technical risk, patient-reported benefit, maintenance, cost and patient preference.

Keywords: Artificial intelligence; complete dentures; dental implants; digital dentistry; evidence-based prosthodontics; fixed prosthodontics.

1. Introduction

Evidence-based medicine was defined as the conscientious, explicit and judicious use of current best evidence in decisions about individual patients. This principle became central to evidence-based dentistry and is particularly relevant to prosthodontics because treatment success is multidimensional.[6,7]

A prosthesis may survive mechanically but fail to satisfy the patient; an implant may osseointegrate while the prosthesis develops technical complications; and a technically precise complete denture may provide poor function in a severely resorbed ridge. Therefore, survival, complications, function, comfort, aesthetics, satisfaction and oral-health-related quality of life must be considered together.[2,8]

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A foundational review of evidence-based prosthodontics emphasized that many prosthodontic interventions have long clinical endpoints, heterogeneous outcome measures and limited high-level evidence. Critical appraisal is therefore essential rather than accepting established teaching solely because it is traditional.[2,9]

2. Foundations of Evidence-Based Prosthodontics

The practical model of EBP integrates three components: the best available external evidence, clinical expertise and patient values and preferences. Research provides estimates of treatment effects; clinical expertise determines applicability and execution; and the patient determines which benefits and burdens are acceptable. [23]

Clinical questions can be structured using PICO—Patient/Problem, Intervention, Comparison and Outcome. Evidence should then be searched and critically appraised according to the clinical question. Randomized trials and systematic reviews are particularly valuable for comparative interventions, but evidence hierarchy is not synonymous with evidence quality; a poorly conducted randomized trial may be less credible than a rigorous prospective cohort study. [25]

Figure 1. Hierarchy of evidence in clinical decision-making (redrawn and adapted from Venkatesan et al.[9]; the source review attributes the original schematic to Burns et al.).

Table 1. Research reporting and appraisal frameworks listed by Venkatesan et al.[9]

Framework	Full name / description
CONSORT	Consolidated Standards of Reporting Trials
TREND	Transparent Reporting of Evaluations with

	Nonrandomized Design
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SORT	Strength of Recommendation Taxonomy
AMSTAR	Assessment of Multiple Systematic Reviews
MOOSE	Meta-analysis of Observational Studies in Epidemiology

57 *Table 2. Knowledge-translation resources listed by Venkatesan et al.[9]*

Database / resource	**URL listed in source article**
CINAHL	www.ebscohost.com/biomedical-libraries/the-cinahl-database
Atlantic Health Promotion Research Centre Knowledge Translation Library, Dalhousie University	www.ahprc.dal.ca/kt/default.asp
Canadian Health Services Research Foundation (CHSRF)	www.cfhi-fcass.ca/WhatWeDo/AppliedResearchandPolicyAnalysis.asp
Cochrane Effective Practice and Organisation of Care Group	www.epoc.cochrane.org/en/index.html
Knowledge Translation + (KT+)	plus.mcmaster.ca/kt/Default.aspx
Keenan Research Centre – Research Programs Joint Program in Knowledge Translation	www.stmichaelshospital.com/research/ktclearinghouse.php
New York Academy of Medicine	www.nyam.org/library/pages/grey-literature-report/

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3. Evidence-Based Diagnosis and Treatment Planning

Evidence-based prosthodontic care begins with diagnosis rather than procedure selection. The clinician should identify the chief complaint, functional limitation, biological condition, prognosis, medical and psychosocial risks, aesthetic expectations and capacity for maintenance. [23]

Treatment alternatives should be compared according to expected benefit, biological cost, technical complexity, financial burden, maintenance and retreatment. Patient-reported outcomes are increasingly important because prosthetic survival alone does not describe the patient's experience.[810]

4. Complete Denture Prosthodontics

Conventional complete dentures remain an important treatment because they are non-invasive and relatively inexpensive, but mandibular instability is a well-recognized limitation, particularly with severe ridge resorption. [8]

No single complete-denture impression philosophy has strong evidence of universal superiority. Selective-pressure, mucostatic and functional approaches should therefore be selected according to ridge anatomy, tissue condition, retention requirements and clinical expertise. A randomized controlled trial has also demonstrated differences in patient preference between impression materials, emphasizing that patient experience should complement technical assessment.[2,11]

Centric relation remains a useful clinical reference, but contemporary evidence challenges simplistic assumptions regarding its absolute reproducibility and its relationship with disease. Vertical dimension should likewise be individualized using facial proportions, phonetics, interocclusal space, aesthetics and patient comfort. [12]

Occlusal scheme is another area in which traditional teaching exceeds the strength of available evidence. A systematic review of systematic reviews found that several schemes can produce satisfactory clinical outcomes, with limitations in the quality of the underlying evidence. Therefore, balanced, lingualized and other schemes should not be presented as universally superior.[13,14]

Denture adhesives can improve retention, stability and patient confidence in appropriately selected patients, but they should complement rather than replace proper denture assessment.

5. Removable Partial Prosthodontics

Evidence-based removable partial prosthodontics emphasizes preservation of remaining teeth and tissues, adequate support and stability, acceptable aesthetics and maintainability. Design should account for periodontal support, ridge anatomy, abutment prognosis, patient dexterity and anticipated future tooth loss. [15]

The shortened dental arch concept illustrates that replacement of every missing tooth is not

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necessarily required when function and patient satisfaction can be maintained. Digital surveying and CAD/CAM frameworks are promising, but long-term comparative clinical evidence remains less mature than for established conventional designs.

6. Fixed Prosthodontics

Tooth-supported fixed dental prostheses have a substantial clinical evidence base. A systematic review reported approximately 89% survival after 10 years for fixed partial dentures, with biological and technical complications influencing long-term performance. [16]

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Digital impression systems can provide clinically acceptable accuracy. A systematic review and meta-analysis comparing digital and conventional impressions for fixed prosthodontics found favorable results in several clinical measures, although performance varies with scanner, preparation geometry, operator and clinical situation. [17]

Modern ceramics include zirconia, lithium disilicate, leucite-reinforced ceramics and resin-based materials. Zirconia demonstrates high short- and medium-term survival in many indications, while veneering fracture and design-related complications remain relevant. Lithium disilicate provides strong evidence for selected single-crown and adhesive indications, particularly where optical properties and adhesive bonding are important.

Material selection should therefore be indication-specific rather than based on the assumption that one material is universally superior.

7. Occlusion and Temporomandibular Disorders

Occlusal concepts remain important in prosthodontics, but evidence does not support the simplistic proposition that occlusion alone causes temporomandibular disorders. TMDs are multifactorial conditions, and irreversible occlusal adjustment should not be used routinely as preventive treatment.

In implant prosthodontics, traditional concerns about non-axial forces are useful biomechanical considerations, but the assumption that non-axial loading inevitably causes implant failure is not supported by strong clinical evidence. [19]

8. Implant Prosthodontics

Implant therapy has transformed prosthodontic rehabilitation. Success depends on implant survival, surgical factors, patient-related risk, prosthetic design, occlusion, peri-implant tissue health and long-term maintenance. Immediate, early and conventional loading can all be successful in appropriately selected situations; loading should therefore be considered together with primary stability, implant distribution and prosthetic design.

Modern implant prosthodontics should avoid rigid rules regarding implant number, loading or prosthetic material. Treatment planning must integrate anatomy, prosthetic space, hygiene, patient expectations, cost and maintenance.

9. Implant Overdentures and the Edentulous Patient

The McGill Consensus Statement followed a symposium at McGill University on 24–25 May

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2002 and concluded that evidence supported a two-implant mandibular overdenture as the first-choice standard of care for many edentulous patients. The statement was a landmark because it challenged the assumption that a conventional mandibular denture should automatically remain the default. [3]

The York Consensus of 2009 followed the McGill statement and emphasized the substantial body of patient-centred evidence demonstrating greater satisfaction and quality of life with mandibular implant-supported overdentures than conventional dentures. It also considered performance, cost and clinical time.[4,5]

Subsequent systematic evidence has confirmed that two-implant mandibular overdentures improve satisfaction, masticatory performance and oral-health-related quality of life compared with conventional dentures.

However, 'first choice' should not be interpreted as 'mandatory for every patient.' Surgery, anatomy, finances, systemic risk, maintenance and patient preference remain decisive. Single-implant overdentures can also be effective in selected patients, although contemporary patient-reported evidence generally favors two implants when both are feasible. [20]

Attachment systems including bars, balls and locator-type designs have all been studied. Evidence does not establish one attachment as universally superior; differences in retention, maintenance and complications should be weighed against patient-specific requirements.[21,22]

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10. Implant-Supported Fixed Complete-Arch Prostheses

Full-arch fixed implant prostheses provide high stability and patient satisfaction but generally require greater surgical, restorative and maintenance resources than overdentures. Contemporary consensus evidence supports several

implant-number strategies when distribution and prosthetic design are appropriate.

The decision between fixed and removable implant rehabilitation should consider lip support, phonetics, prosthetic space, hygiene, anatomy, expectations, finances and maintenance. A technically complex fixed prosthesis is not automatically the best treatment for every patient.

11. Peri-Implant Health, Complications and Maintenance

Long-term implant success extends beyond osseointegration. Peri-implant mucositis, peri-implantitis, screw loosening, fracture, wear and loss of attachment retention can compromise treatment. [23]

Recent evidence indicates that implant-overdenture failures are multifactorial and can relate to patient condition, edentulous arch characteristics, implant number and loading protocol. Regular follow-up and appropriate maintenance are essential. [24]

12. Bone Grafting and Implant Site Development

Guided bone regeneration, ridge preservation, ridge augmentation and sinus augmentation have substantial evidence supporting their use in appropriately selected defects. Consensus recommendations emphasize defect morphology, blood supply, membrane management, stabilization and soft-tissue closure.[25,26]

Autogenous bone, allografts, xenografts and alloplastic materials may all be useful depending on the indication. No graft material should be regarded as universally superior. The evidence-based goal is to select the least morbid predictable approach capable of creating the anatomy required by the planned prosthesis.

13. Contemporary Prosthodontic Biomaterials

Contemporary materials include zirconia, lithium disilicate, resin nanoceramics, high-performance polymers, PMMA and printable resins. Their selection should be based on clinical indication, strength, thickness, bonding, aesthetics, antagonist wear, repairability and long-term evidence.

Laboratory strength should not be equated with clinical superiority. Material performance is influenced by preparation design, manufacturing method, surface treatment, occlusal loading and maintenance.

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14. Digital Prosthodontics

Digital prosthodontics now encompasses intraoral scanning, CAD/CAM, virtual articulation, digital smile design, guided implant workflows and digitally fabricated complete dentures. Its principal advantages include data storage, reproducibility, communication and workflow integration.[17]

Digital workflows should not automatically be described as clinically superior. The evidence is indication-specific and depends on scanner, software, manufacturing process and operator experience.

15. Digital Complete Dentures and Additive Manufacturing

CAD/CAM complete dentures can be milled or printed. Recent clinical evidence indicates that digital workflows can reduce clinical time and provide reproducible fabrication, while retention and mechanical performance vary with manufacturing method and material.[27,28]

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A recent systematic review comparing 3D-printed, milled and conventional complete dentures found broadly comparable outcomes for several clinical variables, while some evidence favored conventional dentures for retention. Therefore, digital dentures should be selected on the basis of the complete workflow and patient requirements rather than technology alone. 28

A 2026 systematic review of digitally versus conventionally fabricated implant-retained overdentures reported fewer prosthetic complications and similar or better patient-reported outcomes with CAD/CAM workflows, although the number of direct comparative clinical studies remained limited. 29

16. Artificial Intelligence in Prosthodontics

Artificial intelligence is being investigated for diagnosis, radiographic interpretation, tooth and landmark detection, shade selection, implant planning, prosthesis design and outcome prediction. Recent reviews demonstrate rapid growth, particularly in prosthesis design and manufacturing.30,31

High retrospective accuracy does not establish clinical effectiveness. External validation, representative datasets, calibration, explainability, privacy, bias assessment and prospective clinical evaluation are necessary. At present, AI is best regarded as decision support and workflow augmentation rather than replacement of clinician judgement.

17. Esthetic, Geriatric and Maxillofacial Prosthodontics

Esthetic prosthodontics increasingly uses facial analysis, smile analysis and digital planning, but biological and functional feasibility must remain primary. Minimally invasive ceramic treatment should preserve sound tooth structure whenever predictable bonding and material thickness can be achieved.

In geriatric and medically compromised patients, evidence-based treatment must consider frailty, dexterity, cognition, xerostomia, medical burden and ability to attend maintenance. A simpler maintainable prosthesis may provide greater overall benefit than a technically complex reconstruction.

Maxillofacial prosthodontics increasingly incorporates osseointegrated implants, digital design and 3D printing for obturators and facial prostheses. Interdisciplinary planning and patient-reported outcomes are particularly important.

18. Patient-Reported Outcomes, Cost and Shared Decision-Making

Prosthodontic success should be measured by meaningful patient benefit as well as technical survival. Implant overdentures and fixed implant prostheses both produce substantial improvements

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in patient-reported outcomes in appropriately selected edentulous patients. 8

Cost-effectiveness should include surgery, laboratory procedures, appointments, maintenance, replacement of attachments, repairs and retreatment. Shared decision-making requires presentation of alternatives, benefits, risks, uncertainties and maintenance requirements.[7,10]

19. Evidence-Based Interpretation of Common Prosthodontic Dogmas

Several traditional propositions should be interpreted cautiously. No single impression technique has universal superiority; facebow transfer is not automatically necessary for every case; no complete-denture occlusal scheme is universally superior; not every edentulous patient requires implants; more implants do not necessarily produce proportionally greater patient benefit; zirconia is not universally superior to metal-ceramic; and digital dentistry is not automatically better than conventional treatment.2,9,13,17

This does not mean that traditional techniques are wrong. It means that the clinician should distinguish between biologically necessary principles, useful techniques and procedures whose routine use has not been demonstrated to change clinically important outcomes.

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20. Evidence Gaps and Future Directions

- Long-term comparative trials of conventional, overdenture and fixed implant rehabilitation.
- Standardized patient-reported outcomes across prosthodontic disciplines.
- Independent long-term evaluation of printable denture and restorative materials.
- Comparative clinical evidence for contemporary ceramic generations.
- Prospective external validation of artificial-intelligence systems.
- Cost-effectiveness studies incorporating maintenance and retreatment.
- Research in frail older adults and medically compromised patients.
- Large clinical registries integrating biological, technical and patient-centered outcomes.

21. Practical Evidence-Based Prosthodontic Algorithm

1. Define the patient's chief complaint and treatment goals.
2. Establish diagnosis, prognosis and biological risk.
3. List conventional, minimally invasive, implant and digital alternatives.
4. Formulate a PICO question for major uncertainties.
5. Search systematic reviews, consensus statements and high-quality clinical trials.
6. Critically appraise quality, effect size, harms, longevity and applicability.
7. Integrate evidence with clinical expertise and patient preference.
8. Discuss cost, maintenance and retreatment.
9. Select the least complex predictable treatment that meets the patient's clinically important goals.
10. Assess outcomes and revise care as the patient's condition and evidence evolve.

22. Conclusion

Evidence-based prosthodontics is a method of clinical reasoning rather than a single treatment protocol. It integrates scientific evidence with clinical expertise and the patient's anatomy, medical

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condition, expectations, resources and preferences. [12]

The evidence base extends across conventional complete dentures, removable partial dentures, fixed prosthodontics, occlusion, implants, regenerative procedures, biomaterials, digital workflows and artificial intelligence. The McGill and York consensus statements are important milestones within this larger field, but they represent only one component of evidence-based prosthodontics. [29]

The future of prosthodontics should therefore avoid both unquestioning adherence to tradition and uncritical adoption of technology. The evidence-based clinician asks whether an intervention provides meaningful, durable and patient-centred benefit, whether the evidence is reliable and applicable, and whether the treatment can be delivered and maintained safely.

References

1. Sackett DL, Rosenberg WMC, Gray JAM, Haynes RB, Richardson WS. Evidence based medicine: what it is and what it isn't. BMJ. 1996;312:71-72.

2. Bidra AS. Evidence-based prosthodontics: Fundamental considerations, limitations, and guidelines. Dent Clin North Am. 2014;58:1-17.

3. Feine JS, Carlsson GE, Awad MA, et al. The McGill Consensus Statement on Overdentures. Int J Prosthodont. 2002;15:413-414.

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4. Thomason JM, Feine J, Exley C, et al. Mandibular two implant-supported overdentures as the first choice standard of care for edentulous patients—the York Consensus Statement. Br Dent J. 2009;207:185-186.

5. Thomason JM, Kelly SA, Bendkowski A, Ellis JS. Two implant retained overdentures—a review of the literature supporting the McGill and York consensus statements. J Dent. 2012;40:22-34.

6. Straus SE, Glasziou P, Richardson WS, Haynes RB. Evidence-Based Medicine: How to Practice and Teach It. 4th ed. Elsevier; 2011.

7. Faggion CM Jr, Tu YK. Evidence-based dentistry: A model for clinical practice. J Dent Educ. 2007;71:825-831.

8. Emami E, de Souza RF, Kabawat M, Feine JS. The impact of edentulism on oral and general health. Int J Dent. 2013;2013:498305.

9. Venkatesan S, Krishnamoorthi D, Raju R, Mohan J, Thomas PA, Rubasree B. Evidence-based prosthodontics. J Pharm Bioallied Sci. 2022;14(Suppl 1):S50-S59. doi:10.4103/jpbs.jpbs_149_22.

10. Schimmel M, et al. Group 4 ITI Consensus Report: Patient benefits following implant treatment in partially and fully edentulous patients. Clin Oral Implants Res. 2023. [Verify complete author list, volume, pages and DOI before submission].

11. Hyde TP, Craddock HL, Gray JC, et al. A randomised controlled trial of complete denture impression materials. J Dent. 2014;42:895-901.

12. Kandasamy S, Greene CS, Obrez A. An evidence-based evaluation of the concept of centric relation in the 21st century. Quintessence Int. 2018;49:975-981.

13. Borges MHR, Miranda LFB, Dini C, et al. Clinical performance of and patient satisfaction with conventional complete dentures with different occlusal schemes: a systematic review of systematic reviews. J Prosthet Dent. 2023;130:341-350.

14. Abduo J. Occlusal schemes for complete dentures: a systematic review. Int J Prosthodont. 2013;26:26-33.

15. Carr AB, Brown DT. McCracken's Removable Partial Prosthodontics. 13th ed. Elsevier; 2016.

16. Tan K, Pjetursson BE, Lang NP, Chan ES. A systematic review of the survival and complication rates of fixed partial dentures after an observation period of at least 5 years. Clin Oral Implants Res. 2004;15:654-666.

17. Chochlidakis KM, Papaspyridakos P, Geminiani A, Chen CJ, Feng IJ, Ercoli C. Digital versus conventional impressions for fixed prosthodontics: a systematic review and meta-analysis. J Prosthet Dent. 2016;116:184-190.e12. doi:10.1016/j.prosdent.2015.12.017.

18. Taylor TD, Wiens J, Carr A. Evidence-based considerations for removable prosthodontic and dental implant occlusion: a literature review. J Prosthet Dent. 2005;94:555-560.

UNDER PEER REVIEW IN IJAR

19. Padmanabhan H, et al. Single implant retained overdenture treatment protocol: a systematic review and meta-analysis. J Prosthodont. 2020. doi:10.1111/jopr.13133. [Verify complete bibliographic details].

20. Payne AGT, Alsabeeha NHM, Atieh MA, Esposito M, Ma S, El-Wegoud MA. Interventions for replacing missing teeth: attachment systems for implant overdentures in edentulous jaws. Cochrane Database Syst Rev. 2018;10:CD008001.

21. Group 2 ITI Consensus Report: Prosthodontics and implant dentistry. Clin Oral Implants Res. 2018. [Verify complete author list and bibliographic details].

22. Peri-implantitis: summary and consensus statements of group 3 of the 6th EAO Consensus Conference 2021. Clin Oral Implants Res. 2021. [Verify complete author list and bibliographic details].

23. Sanz M, et al. Regeneration of alveolar ridge defects. J Clin Periodontol. 2019. [Verify exact title and complete bibliographic details].

24. Urban IA, Monje A. Guided bone regeneration in the treatment of severe alveolar ridge defects. Clin Adv Periodontics. 2019. [Verify volume, issue, pages and DOI].

25. Bidra AS, Taylor TD, Agar JR. Clinical outcomes of CAD-CAM complete dentures: a systematic review. J Prosthet Dent. 2021. [Verify exact publication details].

26. Liu R, Zhao L, Xu L. Research status, technical challenges, and clinical application of digitally fabricated complete dentures: a systematic review. J Prosthet Dent. 2025;134:1107.e1-1107.e12

27. de Sousa LC, Bezerra PTM, Santos JVN, Park JM, E Souza ROA, Carreiro AFP. Clinical and patient-reported outcomes of implant-retained overdentures fabricated by digital and conventional workflows: a systematic review of clinical studies. J Prosthet Dent. 2026;135:e43-e52.

28. Aljulayfi IS, Almatrafi AH, Althubaitiy RO, et al. The potential of artificial intelligence in prosthodontics: a comprehensive review. Med Sci Monit. 2024;30:e944310.

29. Deep learning applications in prosthodontics: a systematic review. J Prosthet Dent. 2025.

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