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Review Article

Are we ready for evidence-based prosthodontics? - A literature review

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ABSTRACT

Traditional methods will be rendered obsolete, if not supplemented by current techniques and evidence. This requires a clinician to continuously recognize, scrutinize and consolidate the best available scientific literature in the field. Continuous improvement in the quality of research conducted, as well as reporting the findings should be encouraged to improve upon current and future treatments. This review showcases the most prominent controversies in prosthodontics and how the current evidence answers the questions. A PubMed, Met line and google scholar search with the keywords, Evidence-based dentistry and Evidence-based Prosthodontics was done from the year 1960-2021. Meta-analysis of randomized control trials and systematic reviews related to the evidence in complete dentures, fixed partial dentures, implants and prosthodontics were considered in the inclusion criteria. Literature reviews and case reports were excluded from the search. Evidence-based practice is a new level of sophistication in the practice of dentistry. Rather than considering the cost of material or the individual preference of the operator, choosing the right technique to maximize clinical efficiency should be based on scientific evidence.

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1. Introduction

In the traditional model of practice (Figure 1), a patient presenting with complaints or symptoms is provided a treatment option that is the “commonly accepted practice” based on the healthcare provider’s observations, personal and expert opinions. In contrast is the concept of evidence-based practice, introduced by David Sackett, who defined it as “The conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research”.¹

Although evidence in prosthodontics is not yet sufficiently mature to offer system guidelines, we have good access to synopses and continue to work with and improve our evidence base. We recognize that evidence is needed to answer contrasting prosthodontic questions and that distinctive study designs are more appropriate for the exploration of different prosthodontic outcomes.² Clinically, when providing prosthodontic treatment, we almost always make and guide daily decisions by weighing the costs of treatment against potential benefits. To do so, we must assess evidence from a variety of resources.

The new paradigm begins with a patient complaining of a problem (Figure 2), and in the absence of an explicit answer, the problem is converted into an answerable question. Evidence is sought from the best current literature, followed by a critical appraisal for its validity and applicability to the present patient. This evidence is then utilized to determine

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Fig. 1: Traditional model of practice

treatment options, without discrediting the structures in the previous model. It has an upper hand over the traditional model because of the increased confidence from evidence, without supplanting the existing clinical judgment.

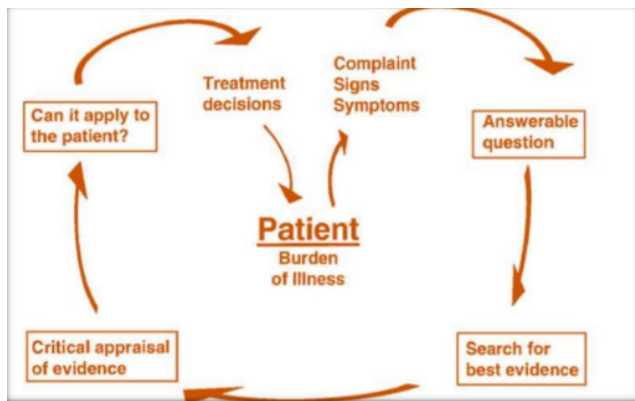


Fig. 2: Model for evidence based practice

Evidence-based dentistry (EBD) is an approach to oral healthcare that requires the judicious integration of systematic assessments of clinically relevant scientific evidence, relating to the patient oral and medical condition and history, with the dentist’s clinical expertise, and the patient’s treatment needs and preferences.³ Currently, there is no definition for evidence-based prosthodontics (EBP) but it is understood that it encompasses the application of EBD concerning prosthodontics.

Some clinicians find themselves overwhelmed with the huge amount of research data available, and therefore choose to generally “browse” through journals, reading only the more interesting articles in slight detail. It has been reported several times that there is a wide variation in dentists’ treatment plans and a lack of consensus on the most effective ones due to the vast array of case studies. These treatment options cannot all be superior.

It requires the clinician to utilize a more “focussed” approach by asking the appropriate research question pertaining to the patient’s problem, acquiring information through an exhaustive literature search; appraising the acquired information; applying the acquired information to clinical practice after incorporating the prosthodontist’s

clinical judgments and assessing the results of the applied technique in the clinical situation. This focussed approach also helps the clinicians create a “library” of all such available treatment options, that can be explored further, should the need arise.

2. Materials and Methods

A Medline, Pubmed and Google scholar bibliographical search (from 1960 to 2021) was carried out. The following search items were explored: “Evidence-based dentistry”, “Evidence-based Prosthodontics”

The eligibility inclusion criteria used for article search were: Prospective cohort studies, Meta-analysis of randomized control trials and systematic reviews related to the evidence in complete dentures, fixed partial dentures, implants and prosthodontics. Literature reviews and case reports were excluded from the search.

3. Considerations in Prosthodontics

The medical and dental treatment methodologies differ greatly in the level of patient involvement over if, how, and when to treat a dental condition, especially in the field of prosthodontics. Reporting treatment outcomes in prosthodontics face hurdles such as no defined outcomes of clinical interest, variable follow-up period, and inadequate sample size.

Additionally, there is ambiguity over how to define the appropriate endpoints of a clinical study. Hujuel and DeRouen⁴ have categorized clinical endpoints as surrogate endpoints- that help preliminary outcomes, and true endpoints- that are helpful for definitive evidence.

4. Evidence in Complete Dentures (CD)

Clinicians have to be mindful to incorporate evidence from literature because despite adhering to traditional techniques for producing high-quality dentures and proper assessment of supporting oral tissues, a huge number of CD wearers experience dissatisfaction with their dentures. Similarly, studies have established that balanced occlusion, thought to increase the stability of dentures is often lost in a short period, without patients complaining about it. While some patients with neurotic tendencies may complain about the dentures consistently, building a good dentist-patient relationship may be more important than the quality of dentures.

Textbooks emphasize orientation relation because it provides references in the cranium for orienting the casts of edentulous jaws to the articulator usually by using face bow record. A recent systematic review of Randomised control trials (RCT) concluded that there is no clinical evidence that can be drawn in favor of the use of Facebow to be essential in the construction of complete dentures, which enhances the denture performance. Simplified approaches

for the construction of complete dentures may present similar results to more complex techniques. Therefore, there is no evidence for the utility of facebow transfer in complete denture treatment. However, no inference could be drawn for its utility in partial denture prosthodontics as there was no study to draw an inference.⁵

It was found through a questionnaire study that in general practice an alarming number of general practitioners skipped the final impression stage and used irreversible hydrocolloid impressions in stock trays as the definitive impressions for fabricating dentures. One School in the US also followed this regimen as they found fewer overextensions of the denture base, fewer post insertion visits, and similar patient satisfaction with the One Step “Abbreviated Technique”. An RCT comparing a simplified and a traditional technique for making complete dentures found no differences between the two in terms of denture quality and patient satisfaction.⁶

Textbooks recommend that to maintain the health of the masticatory system, lost teeth must be replaced. Kayser and colleagues⁷ conducted a series of clinical cross-sectional and longitudinal studies on the shortened dental arch (SDA) to demonstrate that patients can manage well with a reduced number of teeth without severe negative consequences, either as assessed by the patients themselves or according to the professional clinical examination of the function of the masticatory system.

Prosthodontists should not shy away from questioning the evidence provided. For instance, in 2005, Sutton and colleagues reviewed over 1076 RCTs and evidence in the literature to find that there was weak evidence to support advocating dentures with cusps over zero degree teeth. The same team in 2007 carried out an RCT in 45 patients to report that dentures with anatomical occlusal forms are superior in terms of masticatory ability, and provide greater patient satisfaction.

An RCT was carried out involving 85 patients to compare the efficiency of Irreversible hydrocolloid v/s Silicone as secondary impression materials for patients to receive complete Dentures. They concluded Dentures made from elastomeric impressions were preferred by patients over dentures constructed from irreversible hydrocolloid impressions, both before and after the dentures were adjusted. Overall patients preferred the experience of having impressions made in silicone, finding elastomeric impressions more comfortable; however, there was no preference for the taste of either material. Patients’ oral health-related quality of life was better after wearing dentures made from elastomeric impressions. Dentures made from elastomeric impressions were more comfortable, stable, and efficient for chewing.⁸

The concept and application of a temporomandibular joint (TMJ) relationship identified as centric relation (CR) has changed significantly over the past century. Originally

proposed as a biologically reasonable position where maxillary and mandibular dentures should occlude, it later was applied to the dentulous population as well. The term “ideal” was used by the dental community as they sought to define the exact details of CR in terms of condyle-fossa relationships. Assessments of patients’ occlusion were then made in relation to CR, and discrepancies between the two positions were described as being problematic. The clinical application of CR has become a topic of major dental confusion and controversy. To further complicate things, the formal definitions of CR have continuously changed over the past 40 years. Special attention is devoted to the alleged relationships between occlusion, jaw positions, and temporomandibular disorders (TMDs). Current evidence suggests that it is time to stop applying CR concepts to the evaluation and dental treatment of healthy dentulous individuals. For patients with TMDs, it is time to apply current concepts rather than following the 20th-century mechanistic models of fixing dental and skeletal malalignments.⁹

In a systematic review of the occlusal scheme for complete dentures, It was concluded that Anatomical Teeth arranged in Conventional Bilaterally Balanced Occlusion (CBBO), Lingualized Bilaterally balanced occlusion (LBBO) is preferred by patients to flat teeth arranged in monoplane occlusion. Anatomical teeth were preferred to flat teeth in both Subjective and Objective evaluation. No statistically significant difference was found between teeth arranged in CBBO and LBBO for patients with moderate resorption. For patients with marked atrophy, LBBO was found to be advantageous in terms of masticatory efficiency and preservation of intercuspal position. On the evaluation of various studies, it was noted that the advantages of CBBO have been overemphasized. As the settling of dentures occurs within 14 days the bilaterally balanced contacts disappear in the oral cavity. At this point, the contacts between the anatomic teeth on deflective inclines lead to the application of detrimental forces on the residual ridge. Multiple studies have demonstrated a statistically significant difference in the masticatory efficiency of lingualized dentures as compared to BB dentures, thus emphasizing the need for more evidence.¹⁰

In a summary of occlusal patterns and tooth arrangements, Kapur¹¹ disassociated occlusion from denture efficiency. A review of publications comparing various occlusal forms, materials, and occlusal arrangements, including studies since 1972, confirms Kapur’s observation that there is no scientific evidence supporting the use of one occlusal form or arrangement over another.

Based on the current best evidence using the original maxillomandibular relationship with the patients’ teeth in maximum intercuspation, as a reasonable physiologic guide when restoring and replacing teeth in dentulous

patients. The evidence seems to support the logical and compelling notion that a patient's existing and repeatable Jaw relationships should be maintained during routine dental procedures instead of deliberately altering condyle fossa relationships. Any procedure that deviates or positions the condyles away from a position they naturally and physiologically occupy may not only be unnecessary but also can potentially be harmful to the patient in the long term.⁹

An RCT compared balanced occlusion and canine guidance in a group of complete denture wearers. The patients assessed canine-guided dentures to be significantly more satisfying in aesthetic appearance, mandibular denture retention, and chewing ability. Available evidence thus indicates that complete dentures can function successfully without a balanced occlusion.¹²

5. Evidence in Fixed Partial Dentures (FPD)

The success and survival of tooth-borne FPDs are determined by the FDP remaining intact, or the adverse events associated not resulting in its failure respectively. The estimated 10-year survival rate of FDPs was 89%, and the success rate was 71%. While the estimated survival and success rates of cantilever FPDs were lower than previously reported rates for typical end-abutment supported FPDs.¹³

Besides the choice of dental material, another important parameter for the preparation of FPDs is the Total occlusal convergence (TOC), which has increased over the last 4 decades from an unachievable 2-5 degree taper to a more realistic 10-22 degrees.¹⁴

A summary review comparing the corded or cordless techniques for hemostasis and gingival displacement during restorative treatment supports the observation that gingival retraction paste can more effectively help to achieve a dry field and at the same time be less injurious to soft tissues, however, its ability to displace gingival tissues, compared to retraction cord, was compromising. Impregnated gingival cords are more effective on thick gingival tissue whereas paste is more effective when minimal retraction is required for hemostasis control, preservation of the gingiva, and less tissue displacement.¹⁵

Evidence is limited on the efficacy of zirconia-based fixed dental prostheses. Clinical studies have revealed a high rate of fracture for porcelain-veneered zirconia-based restorations that varies between 6% - 15% over a 3 to 5 year period, while for ceramic-metallic restorations the fracture rate ranges between 4% - 10% over ten years. These results provoke uncertainty as to the long-term prognosis for this material in the oral medium.

To date, no scientific evidence for a bond between zirconia and ceramic veneers has been found. The two materials appear to bond employing mechanical engagement and the formation of compressive strength resulting from thermal contraction during cooling after

sintering.¹⁶

In most studies of the mechanical behavior of all ceramic fixed partial prostheses, fractures occurred that were oblique, from gingival to occlusal, from the connector center to the center of the pontic. For this reason, evidence recommends that pontics should be fabricated with an area of 6-9 mm².¹⁶

Evidence on resin bonding related to long-term clinical outcomes of the tooth- and implant-supported high-strength ceramic restorations indicate that porcelain-veneered alumina or zirconia full-coverage crowns and fixed dental prostheses have high long-term survival rates when inserted with conventional cements. However, most of the studies recommend resin bonding and suggest even greater success with composite resins or self-adhesive resin cements, especially for implant-supported restorations.¹⁷

Limited evidence is available for the marginal and internal fit of fixed dental restorations fabricated with digital impressions compared with those fabricated with conventional impressions. A systematic review to compare marginal and internal fit of fixed dental restorations fabricated with digital techniques to those fabricated using conventional impression techniques concluded the digital impression technique provided better marginal and internal fit of fixed restorations than the conventional techniques.¹⁸

The ferrule effect remains controversial from many evidence perspectives. A review concluded the presence of a 1.5- to 2-mm ferrule has a positive effect on fracture resistance of endodontically treated teeth. If the clinical situation does not permit a circumferential ferrule, an incomplete ferrule is considered a better option than a complete lack of ferrule. Providing an adequate ferrule lowers the impact of the post and core system, luting agents, and the final restoration on tooth performance. In teeth with no coronal structure, to provide a ferrule, orthodontic extrusion should be considered rather than surgical crown lengthening. If neither of the alternative methods for providing a ferrule can be performed, available evidence suggests that a poor clinical outcome is very likely.¹⁹

The dental literature has long reported various descriptions of different preparation designs for ceramic veneers. Four common incisal preparation designs that have been described are the window (or intraenamel), the feathered edge, the palatal chamfer (or overlapped), and the butt joint (or incisal bevel). Although the incisal preparation design for ceramic veneers has been widely discussed, there is no consensus on whether an incisal reduction is necessary and how much of the incisal overlap should be provided when an increase in incisal length is not required. The evidence seems to support the use of butt joint over palatal chamfer incisal preparation design. The butt joint is the type of preparation that least affects the strength of the tooth and the chamfer preparation type is more susceptible

to ceramic fractures.²⁰

6. Dental Implants

While oral implants have revolutionized the treatment of edentulous and partially edentulous patients, more than one-third of edentulous subjects opted out of free implant treatment due to fear of surgical procedures and chose complete dentures instead.

The subject of connecting teeth to implants is controversial. The first-line therapy seems to be using free standing implants for supporting fixed dental prostheses whenever possible. Evidence suggests a higher need for maintenance and repair when teeth and implants were connected in comparison to free standing implant support. However, the literature presents three main schools of thought in this regard; one school advocates nonrigid tooth and implant connection; another prefers rigid connection, while the third recommends that implants and teeth should not be connected.²¹

Recommended number of implants for full-arch fixed prostheses is four or five in the mandible but at least six in the maxilla. Less expensive implant-retained overdentures make implant treatment available to a greater portion of edentulous subjects. Mandibular overdentures on two implants, and even one implant, have shown excellent long-term outcomes. In the maxilla, less than four implants are not recommended for predictable results.²²

There is adequate evidence to suggest that a single-dose antibiotic prescribed pre-operatively may reduce the occurrence of implant failures. Administering prophylactic antibiotics before implant surgery can provide significant benefits to patients receiving the treatment. The observed overall reduction in risk provides support for use of prophylactic antibiotics in implant dentistry.²³

A summary review on the effect of different loading times on the outcomes of implant placement concluded that there was no convincing evidence of a clinically important difference in prosthesis failure, implant failure, or bone loss associated with different loading times of implants.²⁴

A summary review on whether platform switching preserves alveolar bone concluded that Platform-switching may preserve interimplant bone height and soft tissue levels. The degree of marginal bone resorption is inversely related to the extent of the implant-abutment mismatch.²⁵

Zirconia-ceramic implant-supported single crowns are a valid treatment alternative to metal-ceramic single crowns, with a similar incidence of biological complications and fewer aesthetic problems. The amount of ceramic chipping was similar between the material groups; yet, significantly more zirconia crowns failed due to material fractures.²⁶

7. Temporomandibular disorders (TMDs)

TMDs were long believed to be caused by occlusal disturbances, and elimination of occlusal interferences with various types of occlusal therapy such as occlusal adjustment was the standard choice of treatment for TMDs. Often TMD patients get better after occlusal adjustment, which strengthens the dentist's belief in an association between occlusal disturbances and TMDs. Only when RCTs were introduced in the TMD field was it revealed that other therapies without effects on occlusion provided equally good or better results.²⁷

In a summary review on TMD'S, clinical studies assessing the association between TMD and features of dental occlusion were considered. Overall there was high variability between occlusal features and TMD diagnosis. Findings were consistent with a lack of clinically relevant association between TMD and dental occlusion. Only two studies were associated with TMD in the majority ($\geq 50\%$) of single variable analyses in patient populations. Only mediotrusive interferences are associated with TMD in the majority of multiple variable analyses. The findings support the absence of a disease-specific association, there is no ground to hypothesize a major role for dental occlusion in the pathophysiology of TMDs. Dental clinicians are thus encouraged to move forward and abandon the old-fashioned gnathological paradigm.²⁸

8. The longevity of restorations

Dentists need to consider various factors when choosing restorative materials, with the longevity of restorations being one of the most important criteria. A review compares the survival rates of different restorative materials used for both direct and indirect restorations.

Porcelain Fused Metal (PFM) restorations have been reported to have a 97% 10-year survival rate. Leucite-reinforced all ceramics reported to have a 99% survival rate after 3.5 years, and a 95% survival after 11 years. Veneered ceramic over zirconia restorations have shown survival rates of 96% after two years, and 94% after four years. Fixed bridges can be divided into PFM and all-ceramic. Studies have shown survival rates to be 92% over 10 years, and 75% over 15 years for the PFM type, 93% survival rates over five years for zirconia, and 89% survival rates over five years for all-ceramic FPD's.²⁹

9. Limitations of Evidence-Based Prosthodontics

EBP suffers because research can often be limited in terms of applicability to the specific patient population. Critics often argue that EBD can't be applied to prosthodontics because the evidence from clinical research may not directly answer the principal clinical question of what is best for a specific patient, since the homogeneity and characteristics of patients participating in clinical trials may significantly

differ from those seen in dental offices. Additional concerns include publication biases, paucity of current data, cost, and ethics.

EBP though strongly encouraged is not binding, and requires the prosthodontist's clinical expertise and judgment in clinical decision-making. Additionally, care should be taken that EBD does not interfere in the dentist-patient relationship by blatantly disregarding the patient's needs and preferences.

10. Current and Future Perspectives

Prosthodontics because of its unique nature, finds itself lacking in system guidelines. Efforts need to be made to establish explicit guidelines for reporting outcomes that answer different prosthodontic questions. Despite this lack of consensus and system guidelines, a lot of literature is available that answer different prosthodontic questions and strengthen the evidence base.

Though evidence-based dentistry is relatively new compared to the traditional model of care, it aids clinical decision-making by helping clinicians question and understand the validity and relevance of published literature and other available evidence. Care should be taken to resolve clinical questions for which there is weak evidence, particularly in the areas of long-term survival and treatment success.

It is understood that some evidence answers specific prosthodontic questions better, and some study designs are more apt than others at addressing certain prosthodontic outcomes; examples of these include a choice of different dental materials with randomized clinical trials, cross-sectional surveys in patient-centered studies, and longevity of prostheses.

With technological advances, barriers to accessing evidence and information are ever decreasing. A wide variety of databases and search engines make information either freely available or accessible through library subscriptions. Clinicians have to keep themselves abreast with newer techniques and guidelines.

11. Conclusion

A select few prosthodontists understand the potential and sophistication of evidence-based prosthodontics since it was first suggested. It is being increasingly incorporated into curricula by encouraging younger dentists not to blindly follow conclusions from weak evidence provided in the literature, while still being on the lookout for diverse treatment options that are supported by case series and good case report designs. It would greatly benefit clinicians to assess, propose, and participate in evidence-based research studies that will help establish a practice-based research network to address relevant treatment options for improved oral health care.

Evidence-based practice is a new level of sophistication in the practice of dentistry. Current clinical skills and judgments are needed as much as ever, and one can continue to browse the literature looking for the best evidence in support of treatment. However, evidence from prosthetics, reveals a diversity of treatment that can be justified only based on weak case series and case report designs.

The evidence from medicine suggests that evidence-based practice does affect clinical decisions, and preserves clinical skills. There are ways of obtaining literature efficiently and effectively, and a special set of skills is required to critically appraise it for the strength of evidence. Those skills must be developed and made central to specialty training programs. The weak link in the system at the moment appears to be the methodologic quality of the literature. With more demanding patients and more discerning readers, editors, and authors will be compelled to provide more rigorous research. Rather than considering the cost of material or the individual preference of the operator, choosing the right technique to maximize clinical efficiency should be based on scientific evidence.

The scarcity of RCTs and difficulty in conducting such trials will necessitate the evaluation of studies on lower evidence levels to draw any relevant conclusions. Systematic reviews of available literature have been shown to provide valuable guidelines for clinicians in decision-making. Clinical practice should be based on the best possible evidence and include the clinical experience and expertise of the therapeutic team as well as the patients' wishes and preferences. In the longer perspective, many of today's "truths" will be questioned, and dogmas that lack strong evidence will be abandoned. The prosthodontic community should take an active part in this process.

The current strategic direction chosen by prosthodontics is an extended commitment to change. There are three ways to approach change. You can fight it and fail; you can accept it and survive, or you can lead it and prosper.

12. Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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None.

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