



Review

Critical review of some dogmas in prosthodontics

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Abstract

Purpose: In prosthodontics like in other dental disciplines there are many clinical procedures that lack support of good evidence, which means that the effect is unknown, and even worse, we do not know if they do more good than harm. It is the aim of this paper to review current evidence for selected procedures based on a scrutiny of the prosthodontic literature.

Study selection: A MEDLINE/PubMed search was conducted for articles on the selected items with a focus on best available evidence.

Results: Many “old truths” regarding prosthodontic interventions can be called dogmas, opinions based more on belief than scientific evidence. There is, for example, lack of evidence to support the opinion that a face-bow is necessary in the fabrication of prostheses, and many theories related to occlusion are not evidence-based. Some such dogmas in various areas of the discipline are exemplified and discussed in the article.

Conclusion: A scrutiny of the prosthodontic literature indicates that many common clinical procedures lack scientific support. In the era of evidence-based dentistry, ineffective interventions should be eliminated and decisions should be made on best available evidence.

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Keywords: Complete dentures; Dental occlusion; Evidence-based care; Jaw registration; Oral implants

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1. Introduction

A dogma is defined as a belief or opinion held to be true. On closer scrutiny, many such dogmas lack evidence to be valid but

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Table 1
Grading of evidence in the literature

Level	Type of evidence
Ia	Evidence from systematic reviews of RCT
Ib	Evidence from at least one RCT
IIa	Evidence from at least one controlled study without randomization
IIb	Evidence from at least one well-designed quasi-experimental study
III	Evidence from non-experimental descriptive studies, such as comparative, correlation, cohort, and case-control studies
IV	Evidence from expert committee reports, consensus conferences, and opinions or clinical experience of recognized authorities

are still cherished with implicit faith. A well-known historical example of the risk of questioning dogmas is what happened to Galileo Galilei, when he disavowed that earth was the centre of the universe, the article of faith at that time. In 1632 the Church in Rome forced him to abjure this theory and sentenced him to life imprisonment, later on mitigated to lifelong house arrest. In 1992, 360 years later, the Pope declared the Galileo case closed. Errors had been made . . .

To question dogmas may still be risky, e.g. in most religions, in non-democratic societies, in political parties, and even in the scientific community if you are a researcher who presents results that do not fit into existing paradigms. A paradigm, i.e. opinions that members within a scientific branch share, may lead to considerable restriction of one's field of view, and attempts of a paradigm shift usually generate great resistance [1]. Such an attitude to new findings may have devastating consequences for scientific development as has been expressed by a famous scientist: "It is what we think we know that prevents us from learning more" (Albert Einstein, 1879–1955). Another citation of relevance when discussing old dogmas is: "Science is not to solve the extreme questions. Science is to gradually terminate preconceived opinions" (Niels Bohr, 1885–1962). The following statement should always be considered by clinicians both in medicine and dentistry: "Half of what you are taught as medical students will in 10 years have been shown to be wrong, and the trouble is none of your teachers knows which half" (Sidney Burwell, 1893–1956). It can be argued that the period is even shorter today, perhaps only five years.

To critically inspect current opinions of clinical methods is an essential part in the development of evidence-based care. It is the aim of this paper to review current evidence for some selected clinical procedures in prosthodontics based on a scrutiny of the literature.

2. Materials and methods

MEDLINE/PubMed searches were conducted for articles on selected aspects of clinical prosthodontic procedures with a focus on best available evidence. Since the prosthodontic literature is abundant (78,430 hits in PubMed; April 21, 2008) the review was limited to studies of the highest possible level of evidence (Table 1). If publications of the highest levels, i.e. clinical randomized controlled trials (RCT) and systematic reviews of RCTs, were not available, other studies were considered. The selected areas included various aspects of complete denture fabrication, jaw registration methods, tooth

loss and the health of the masticatory system, the role of oral implants in prosthodontic treatment, and the role of occlusion in temporomandibular disorders (TMDs). Because of space limitations, the review is condensed and focused on specific aspects of the selected areas.

3. Evidence-based care

It has been demonstrated that only a minor part of all methods that are routinely used in clinical dentistry has strong scientific support. It is hardly any comfort for dentists that the situation is similar in medical care [2]. Investigations of high quality are required for valid comparisons between different methods, materials, and medications. It is well established that among various study designs, the RCTs give the strongest evidence, which is reflected in the hierarchy of scientific strength (Table 1). RCTs can easily be done in comparisons of various drugs, but they are difficult to conduct in restorative dentistry and almost impossible for extensive treatments such as oral rehabilitation. Thus, no RCT seems to have been performed to compare clinical results of conventional fixed prostheses on teeth and implant-supported reconstructions for replacement of lost teeth. An extensive study of the prosthodontic literature up to the end of 2000 identified 90 RCTs, but the critical authors maintained that only a small part of them was presented in accordance with current requirements of reporting scientific studies, which made the interpretation of the results difficult [3].

It can be concluded that only a minor part of all questions in clinical prosthodontics can be answered with strong evidence. The situation is similar in other dental disciplines as well as in the medical fields [4].

4. Review of some dogmas regarding complete denture fabrication

4.1. Quality of dentures and patient satisfaction

Textbooks and undergraduate teaching have strongly emphasized that the best way to achieve a successful outcome of complete denture treatment is to strictly follow the traditional prosthodontic rules for optimal quality. Over the years, however, several studies have demonstrated that there is often poor correlation between a dentist's assessment of denture quality and a patient's satisfaction with the treatment [5–7]. The majority of complete denture wearers are satisfied with their dentures, irrespective of denture quality, and some 10–20% are

dissatisfied even if the dentures are constructed according to the best known prosthodontic rules [8]. In a study of 500 complete denture wearers, a close correlation was found between patient and dentist appreciation when the dentures were rated as poor, but little or no correspondence when dentists and patients rated the dentures highly [9]. This can explain why we sometimes have patients who complain about the dentures when we assess the quality as excellent.

It is a common clinical opinion that there is a relationship between the qualities of the anatomical conditions (e.g. height of residual ridges, characteristics of mucosal tissues, etc.) and the outcome of the denture treatment. However, several studies have failed to show strong correlations between such factors and patient satisfaction with the dentures [6,7,10,11]. One of these studies concluded that clinicians' assessments of the quality of denture-supporting tissues are poor predictors of patient satisfaction with mandibular prostheses [7].

The rationale of relining and replacing poorly fitting dentures is to improve denture quality, and most patients experience an improvement, but all are not satisfied. This underlines the often poor correlation between denture quality and patient satisfaction [12,13]. It must also be remembered that bite force and masticatory performance tend to diminish rather than increase for a substantial time period after delivery of new dentures [14,15]. There is also no certain evidence that making better complete dentures will change the dietary selection or improve the quality of diet in edentulous subjects [16,17]. Studies that also included comparison with implant-supported prostheses, found improved chewing ability, but no dietary changes after treatment [18–20]. All these studies concluded that, in the absence of tailored dietary advice, successful rehabilitation, including improved chewing capacity, does not necessarily result in a satisfactory diet.

4.2. Psychological factors

The lack of strong evidence for an association between anatomical and technical prerequisites of a successful treatment with complete dentures should be balanced with the fact that psychological factors and the patient's – and the dentist's – personality are of great importance for the outcome of treatment [21]. Several studies have demonstrated that dentists' and patients' interpersonal appraisals of each other were most significant factors, accounting for patients' evaluation of treatment outcome [22,23]. Reviews of the literature on this topic have suggested that the creation of a good relationship with the patient seems to be more important than a technically perfect denture construction for achieving patient satisfaction [24–26].

4.3. Jaw relation records

Practically all textbooks in prosthodontics have described a face-bow record as necessary for orienting the casts to the articulator for all types of prosthetic work. It is generally suggested that the more sophisticated and complex methods that are used, the better the results that will be achieved. This

belief was refuted with respect to fabrication of complete dentures in a classical longitudinal series of RCTs initiated in 1969 [27]. The studies compared 64 edentulous patients randomly allocated to two treatment groups: one complex technique involving, among other things, hinge-axis location for a face-bow transfer to an advanced articulator, the other using a simple technique without face-bow and with an arbitrary mounting in a simple articulator. No significant differences in outcome between the two patient groups could be established in the short- or long-term follow-ups over 20 years, either in the professional or patient evaluations of dentures and clinical results [28]. In spite of the strong evidence that this series of well conducted studies provided, the belief in the necessity to use face-bows continued in most prosthodontic literature and teaching well into the new millennium [29,30]. Among many general practitioners, the value of the face-bow has been questioned and in Scandinavia practically all dentists abandoned the use of face-bows long ago, not only for complete denture fabrication, but also in other types of prosthodontic work. Already in 1991, the Scandinavian Society for Prosthetic Dentistry (SSPD) presented a consensus publication stating that a face-bow is not necessary and recommended simple methods in jaw recording for all types of prosthodontic work. Average mounting in the articulator is sufficient and easy to perform. The message was based on the fact that there was no published evidence that the use of a face-bow will lead to better clinical end results than when not using a face-bow, nor has any such evidence appeared since then [29]. There are no studies that contradict the opinion that an average setting of the articulator is satisfactory, for example, 30° for the sagittal and 15° for the lateral condylar path inclination.

Now more studies are appearing corroborating that mounting in the articulator with or without face-bow gives similar clinical results [31–34]. One of these studies comparing the traditional and a simplified technique in producing complete dentures concluded, “the quality of complete dentures does not suffer when manufacturing techniques are simplified to save time and materials. Dental educators should consider these findings when redesigning prosthodontic training programs” [33]. This suggestion also fits in well with the concept of *Appropriatech*: “To provide treatment for the many, cost-effective conventional treatment is required, but with adequate quality control” [35].

4.4. Occlusion

The concept that complete dentures need balanced occlusion to create stability has been so dominant in textbooks that it deserves to be characterized as a dogma. However, the statement has been questioned since balance is often lost during chewing. Studies have also demonstrated that the balanced occlusion existing at delivery of the dentures is often lost within a relatively short time, without patients complaining about it [36,37].

Some gnathologically oriented dentists have maintained, without being believed by most prosthodontists, that complete dentures with canine-guided occlusion can function well. A controlled study 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 [38]. Available evidence thus indicates that complete dentures can function successfully without a balanced occlusion. This is thus an example of another “old truth” that needs to be modified.

Other factors related to complete denture occlusion, such as occlusal pattern, form, material, and arrangement of the artificial teeth have been the focus of heated discussions during many decades, but there is a lack of well-controlled studies. A Cochrane Review on occlusal schemes identified more than 1000 titles, but only one study that fully met the inclusion criteria of scientific quality [39]. This study compared lingualized teeth with cusps with zero-degree teeth. It was concluded that there was weak evidence for recommending teeth with cusps since significantly more of the patients preferred them compared to cusplless teeth. One more study can now be added to the mentioned one, a recent RCT compared three types of posterior occlusal forms for complete dentures. Lingualized and anatomic occlusal forms were perceived to be significantly superior in terms of chewing ability, when compared with zero-degree posterior occlusal surfaces [40].

An extensive review of the literature on complete denture occlusion concluded, “Despite its biomechanical importance, occlusion, as well as the technical quality of the denture, plays only a minor role in determining success or failure of a denture treatment. A number of psychosocial factors are likely to be more important than prosthodontic factors for a positive outcome” [24].

4.5. Impressions

Most textbooks advocate a two-stage procedure: (1) preliminary impression, often with an irreversible hydrocolloid (alginate) in a stock tray; and (2) final impression in a custom tray usually made of acrylic resin. There are many materials for the final impression, such as gypsum, zinc oxide and eugenol (ZOE) paste, polysulfide rubber, polyether, polyvinyl siloxane, and alginate.

Preferences vary much among dentists. However, there is no evidence that one technique or material produces better long-term results than another. Among hundreds of articles on impression materials and methods, only two controlled studies were found. The first one compared fluid wax and polysulfide rubber for mandibular complete denture impression and demonstrated that there was no difference in adjustment of the dentures up to one year after delivery [41]. The other controlled study compared three materials for the final impression in 11 patients. It was found that ZOE was the least favored material, and the authors concluded that care should be exercised when selecting impression materials when constructing mandibular complete dentures [42].

Without strong evidence for recommending a specific impression material and technique it is of interest to know the normal practice for complete dentures among general practitioners. A survey in a region in the UK revealed that practically

all responding dentists used alginates for primary impressions. Also for the secondary impression irreversible hydrocolloid was mentioned as an option by 94%, ZOE paste by 29%, and polyvinyl siloxane by 13% (more than one material could be mentioned). Laboratory special trays were used by 75% for the final impression [43]. In North American dental schools 98% used custom trays with border molding for final impressions, but with variation regarding materials used [44]. There does not seem to be any evidence of better clinical long-term results with dentures made with than without boulder molding [45].

Many general practitioners use a single alginate impression as the definitive impression for the construction of complete dentures, which conflicts with the teaching in practically all dental schools. It is, therefore, of interest that a RCT found neither patient assessed nor dentist evaluated differences between dentures fabricated according to a traditional or a simplified method. The simple technique used alginate in a standard tray for the definitive impression, whereas the traditional technique included an individual tray with border molding and polyether for the final impression [33]. Although impression materials differ in many aspects and a variety of techniques exist in taking the impressions, there is no evidence to conclude that the clinical long-term outcome of dentures fabricated using varying materials and methods would differ significantly. These and other aspects of variation in methods and techniques are discussed in a review of an evidence base for complete dentures [45].

5. Loss of teeth and the health of the masticatory system

For a long time, it was stated so frequently in prosthodontic textbooks and dental school education that it stood out as a dogma: teeth that are lost must be replaced if the health of the masticatory system is to be maintained. Some clinicians dared to question this dogma, e.g. the American prosthodontist De Van, who already in 1951, when discussing indications for removable partial dentures (RPDs), wrote: “Many times it is much better to preserve what is left instead of replacing what has been lost” [46]. Half a century later, the international prosthodontic community seems to agree with this statement on RPDs [47]. However, it was the Dutch prosthodontist Käyser who started an unyielding campaign against the dogma when, in 1981, he published his opinions on the shortened dental arch (SDA) [48]. His message was that there is sufficient adaptive capacity in subjects with SDA when at least four occlusal units are left. His and his successor’s research groups have conducted a series of clinical cross-sectional and longitudinal studies on SDA. The results have convincingly demonstrated that most people can manage well with a reduced number of teeth without severe negative consequences, either as assessed by the patients themselves or according to professional clinical examination of the function of the masticatory system. The conclusion has been that earlier presumptions of the negative sequelae of loss of teeth were exaggerated. An extensive review of the literature on SDA could not identify any systematic clinical studies from other centres refuting the main results of the Dutch group [49].

The SDA concept was first received with skepticism, and those who believed in the necessity of a complete dentition considered it heretical. However, the SDA concept has gradually met increased acceptance [50,51]. The WHO guidelines published in 1992 provided strong support by suggesting that the SDA concept was a possible clinical alternative in situations when economy and service resources are limited [52]. Shortened dental arches comprising anterior and premolar teeth fulfill in general the requirements of a functional dentition. This statement is of great importance for the large number of people in the world that lack possibilities to pay for extensive and high-cost dental care. Even in the wealthiest countries, substantial parts of the population do not have economical means to ask for complete prosthodontic treatment when affected by tooth losses [35]. Patients' needs and demands vary much and should be individually assessed, but the SDA concept deserves to be included in the treatment planning process. In complex treatment plans, the SDA approach offers alternatives of less treatment that is also less complicated, time-consuming, and expensive. The SDA concept has significantly influenced prosthodontic thinking in the past few decades and received well-deserved attention. However, with ongoing global changes, e.g. in dental health and economy, the SDA concept requires continuing research and discussion [49].

A healthy, complete natural dentition is of course an ideal worth aiming at whenever feasible. From the literature it can be concluded, however, that the earlier professional belief in full reconstitution of reduced dental arches per se as a prerequisite for optimal oral health and function lacks compelling scientific support [51]. A concept that has recently received increasing attention is that perceived oral health is not related only to the level of oral function, but also to psychological factors. A Japanese study examined the relationship between missing occlusal units and oral health-related quality of life (OHRQoL) in patients with SDA [53]. The results suggested that missing occlusal units were related to impairment of OHRQoL in subjects with SDA. Quality of life aspects certainly deserve to be more studied in various areas of prosthodontics.

6. Oral implants will solve all problems

Oral implants have revolutionized the treatment of edentulous and partially edentulous patients. Within a few decades after the introduction of osseointegrated implants [54], previously unforeseen possibilities have been developed to help patients suffering of functional and psychological problems with conventional removable dentures. The successful results of implant treatment have been followed by an explosive development of new materials and methods including a great variety of brands of implant designs, most of which, more or less, resemble the original titanium screw implant. The rapidly growing implant market has created what by many is considered a dogma: implants can solve all problems related to tooth loss. This is of course not true. The greatest obstacle is economic. Up to now probably less than 1% of edentulous people in the world have received implant treatment. Neither will the great majority of the

world's edentulous individuals be able to afford such treatment in the foreseeable future. There are also other obstacles. An interesting study in Canada showed that more than one third (36%) of edentulous subjects declined implant treatment despite it being offered free of charge [55]. The reasons for the refusal varied, but the most common was that the complete dentures functioned well, and many people fear the surgical operation and the subsequent treatment. Other studies have also reported fairly high proportions of individuals who say that they would never consider receiving dental implants [56,57].

The recommendations expressed above all by implant manufacturers to extract teeth and replace them with implants have been contradicted by recent systematic reviews that have concluded that the survival rate of teeth are higher than that of implants. This was true also for compromised, but successfully treated and maintained, teeth [58,59].

6.1. Prosthetic complications

The spread opinion that implant treatment is more secure than conventional fixed prostheses is not in accordance with current literature. Several longitudinal studies have demonstrated that complications after implant treatment are common and repair and remaking of the reconstructions can be both time-consuming and costly [60]. In the absence of RCTs comparing long-term results of conventional fixed prostheses and implant-supported reconstructions, systematic reviews have shown that the incidence of technical complications was higher for implant-supported than for tooth-supported reconstructions [61]. Dentists should observe these results and the patients must be informed before the start of the treatment.

6.2. Implant failure

Loss of implants after loading is rare, especially in the mandible [62]. Sometimes a failure occurs and the reason is often difficult to establish. Occlusal conditions and overloading have often been proposed as the most important cause of late failures, sometimes with such an emphasis that it has been looked upon as a dogma by many people. Evidence for this opinion has been demonstrated only in a single animal study, whereas it has been difficult to prove an association between overload and implant failure in human studies. A consensus conference in 2006 concluded, "Although it has been postulated from clinical studies that occlusal forces have been associated with a loss of oral implants, a causative relationship has never been convincingly demonstrated" [63]. At present, it thus seems that the dogma of an association between occlusal forces and implant failure, regarding the biological effects, should be abandoned. On the other hand, it is clear that heavy occlusal load may have negative effects on the implant supra-structure, e.g. fractures of components [64].

Oral implants offer fantastic possibilities to treat patients who have lost teeth, but they cannot solve all therapeutic problems. There are many reasons to further develop conventional prosthodontics because in the foreseeable future tooth-borne crowns and fixed dental prostheses as well as removable dentures will

continue to be the most common treatment alternatives in general practice.

7. Dogmas related to temporomandibular disorders

The literature on TMDs has over the years exhibited a great number of controversial opinions, which has created much confusion, especially regarding diagnosis and treatment of TMDs. Already the numerous names given to the disorders during the past decades indicate different views on the etiology, which naturally have had influence on the management of the patients. For long, TMD patients were managed in prosthodontic clinics in many countries with a focus on occlusal etiology. During the past few decades special TMD clinics have appeared in many places and the focus has changed to psychological factors and pain physiology [65,66]. This review will be limited to two controversial areas, the role of occlusion and occlusal splints.

7.1. The role of occlusion in TMD etiology

Occlusal disturbances were for long believed to be the dominant cause of TMDs. It is no exaggeration to say that for many clinicians the close relationship between TMDs and occlusion was a dogma. Elimination of so-called occlusal interferences with various types of occlusal therapy such as occlusal adjustment was taught in dental schools and became a common treatment modality for TMD in general practice. TMD patients often 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. Systematic literature reviews have demonstrated that the association between occlusal factors and TMDs is weak and consequently there is seldom an indication for irreversible occlusal therapy in TMD patients [67–70]. Simple treatments including brief information, counseling/reassurance, analgesic medication for pain relief, and jaw exercises will help the majority of patients with TMD [65,66]. A recent Japanese study on TMD patients comparing the treatment outcome between two clinics, one focusing on occlusal therapy and splints, the other on patient education and physiotherapy, found better results for the latter [71]. A systematic review compared simple versus multimodal therapy in TMD patients [72]. It was concluded that patients without major psychological symptoms do not require more than simple therapy, such as brief information, self-care instructions, home remedies, and over-the-counter drugs.

7.2. Occlusal splints/intraoral appliances

Many dentists have had difficulties to abandon the opinion of a close relationship between occlusal disturbances and TMDs as it was earlier taught in most dental schools. The good treatment outcome of occlusal splints is often put forward as an argument that the occlusion is etiologically important. The

Table 2

Proposed mechanisms explaining the treatment effect of intraoral appliances (besides the possible influence on the occlusion)

Mechanisms discussed in the literature

Occlusal disengagement

Neurophysiologic effects on the masticatory system

Change of vertical dimension

Change of caput–fossa relation

Cognitive awareness of harmful behavior (e.g. parafunctions)

Stress absorber/reduced load on masticatory system components

Placebo effect

name of the most common splint, the stabilization appliance, suggests that an improvement of the occlusion should explain the treatment effect. However, there are other possible mechanisms (Table 2). An anterior bite plate with occlusal contacts only on the incisors and canines has proven to be as effective as a stabilization splint. And to many a surprising result: a so-called placebo splint that only covers the palate without touching the occlusion is largely as effective as an occlusal splint [73]. It has been proposed that occlusal splints are temporary means like crutches in orthopedic treatment, and the outcome can be explained as effects of, for example, placebo, the time factor, and the fluctuation of the complaints [74]. In spite of the more critical attitude toward the traditional explanations of the efficacy, there is currently close to consensus among TMD experts that an occlusal splint provides an efficient treatment in the management of TMD patients. However, the mechanism of action is not clear, and the effect is probably not at all, or only to a small extent, influenced by the occlusion. A consequence would be to call these devices intraoral appliances rather than occlusal splints.

8. Discussion

Many “old truths” in prosthodontics and occlusion can be characterized as dogmas based more on belief than science. Some such dogmas have been exemplified in the article but many more exist as demonstrated in a recently published extensive review [75]. The focus has been on the fabrication of complete dentures, but it is easy to find corresponding lack of strict scientific support in other areas of prosthodontics. In fact, only a minor part of all opinions that governs the activities in clinical dentistry – as well as in medicine – is based on strong evidence. Without good evidence it is unnecessarily difficult and uncertain to make clinical decisions. There is, therefore, need for more research with systematic and controlled studies to be able to answer the many remaining controversial questions and improve the quality and security of clinical care. Biological, psychological, economical, and quality-of-life aspects should be incorporated in the research besides clinical comparisons between different therapies. The scarcity of RCTs and difficulty in conducting such trials will necessitate the evaluation of studies on lower evidence levels (Table 1) to draw any relevant conclusions. Systematic reviews of available literature have been shown to provide valuable guidelines for clinicians in decision-making [76–78]. 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.

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