

Gold Standards in Periodontics: A Review

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ABSTRACT

The field of dentistry has evolved where people expect the best oral health care from specialists. Periodontics is that specialty of dentistry which deals with prevention, diagnosis, and treatment of diseases of the supporting tissues of the teeth. Almost half of the world's population is suffering from periodontal diseases. Periodontitis is the sixth most common chronic diseases in the world and along with dental caries, the most common cause of tooth loss. Through the effort of various professional organisations and research, various reliable products and treatment modalities have been developed. A gold standard is a benchmark which has been thoroughly tested and has reputation as a reliable modality. Some of established gold standards in periodontics include: periodontal probing, measurement of clinical attachment loss, bone loss, cone beam computed tomography, quantitative polymerase chain reaction tests, biopsies as investigative techniques; periodontal debridement, subepithelial connective tissue graft for recession coverage, lasers, autogenous bone in alveolar ridge augmentation prior to oral implantation, dental implant as reconstruction of missing dentition, and chlorhexidine mouth wash as treatment options. The objective of the review is to provide critical evaluation of the data available from existing studies in Periodontics which can help identify potential research areas to explore.

Keywords: Clinical attachment loss; gold standard; periodontal debridement; periodontics.

INTRODUCTION

Periodontics is that dental specialty dealing with prevention, diagnosis, and treatment of diseases of teeth or their substitute's supporting tissues; health, function, aesthetics and maintenance; and replacement by grafting or implantation of natural and synthetic devices and materials.¹ Periodontal disease is inflammatory disease caused by interaction between periodontal pathogens and components of host immune response.² Prevalence of periodontitis ranges from 20-50% around the globe.³

A gold standard is a benchmark material or method applicable in reasonable conditions and has reliable reputation. It is not perfect modality, but the best available that is standard with known result. This is especially important when subjected with impossibility of direct measurements.⁴ An ideal method hypothetically presents a sensitivity of 100% with respect to detection of illness and a specificity of 100%. In practice, there is no perfect gold standard but options with greatest sensitivity and highest specificity are chosen.⁵

Micro computed tomography can be considered gold standard for diagnosis of proximal carious lesions of posterior teeth, as microscopic examination of enamel has demonstrated its accuracy.⁶ The objective of the review is to provide critical evaluation of data available from existing studies in Periodontics to help identify potential research areas to explore newer gold standards.

GOLD STANDARDS IN ASSESSMENT OF PERIODONTAL HEALTH

The measurement of clinical attachment loss (CAL) with a periodontal probe is a gold standard for quantifying the progression of periodontitis. This tool provides a numerical metric that reflects the degree of apical epithelial attachment measured from gingival margin and is critical for disease staging.⁷

In the assessment of periodontal disease status, both periodontal probing depths (PPD) and CAL are used as measures of past destruction. Whole-mouth examination, that is examination of 6 sites per tooth on all existing teeth, is currently considered the gold standard.⁸ CAL and bone loss as seen in radiographs are the gold standards used to help distinguish a patient with gingivitis from one with periodontitis. Patients with gingivitis do not exhibit CAL and bone loss (radiographically), whereas when disease progresses to periodontitis, patients exhibit both of those traits.⁹

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Florida probe has been shown to be more accurate and more consistent which was reproduced by two independent examiners.¹⁰

Although the periodontal probe, recognised as a gold standard, can monitor gingival health and also detect periodontitis, it can cause pain and is also susceptible to errors. A hybrid imaging modality combining visible and near infrared excitation with acoustic detection, photoacoustic imaging, generates wideband acoustic waves that can be detected with ultrasound transducers for image generation.¹¹

An important gold standard for periodontal diagnosis and treatment planning includes full-mouth evaluations of paralleling periapical radiographs. The European Federation of Periodontology prefers full-mouth series of periapical radiographs in higher education and training in periodontology.¹²

Actual surgical evaluation is the gold standard for measurements of alveolar bone defects caused due to periodontal disease. Cone beam computed tomography (CBCT) measurements were compared to it.¹³

Bacterial culture is the gold standard in periodontal microbiology. It remains the most objective technique as no other method can analyse the sensitivities of pathogens to antibiotics. Improved quantitative polymerase chain reaction (PCR) tests may have an important role in future of periodontal diagnosis, once it has been validated with well-designed clinical trials.¹⁴ However, bacterial culture may be difficult because of multibacterial nature of periodontal diseases.

The histopathologic assessment of a tissue biopsy from the lesion is recognised as the current gold standard for diagnosis of tumors. Thus, biopsy still remains the gold standard.¹⁵

GOLD STANDARDS IN PERIODONTAL TREATMENT MODALITIES

Periodontal debridement (PD) for the treatment of inflammatory periodontitis remains a gold standard.¹⁶ The causal relationship between oral biofilm and the host inflammatory response of periodontal disease has substantially increased. Despite development of technology, PD remains the gold standard of inflammatory periodontitis treatment.¹⁷ Minimally invasive nonsurgical techniques (MINST) recently introduced in the periodontal field instead of minimally invasive surgical techniques (MIST) has achieved satisfactory results.¹⁸

Autologous bone material has shown proven results in alveolar ridge reconstructions, and sinus elevation prior to implant insertion. The clinical results indicate that autologous bone grafts remain the gold standard because of their osteoinductive and osteogenic possibilities.¹⁹ Bone morphogenetic protein (BMP-2) represents a promising alternative to gold standard autogenous bone.²⁰

The use of free gingival grafts and pedicle flaps, and pedicle coronally positioned flaps in the treatment of single and multiple gingival recessions are considered the gold standard.²¹

Chambrone et al.²² from randomised clinical trials, systematic review and meta-analysis data has evaluated periodontal plastic surgery in the treatment of gingival recessions.

The role of subepithelial connective tissue grafts, with or without a coronally advanced flap with long-term stability and gain in keratinised tissue as the “gold standard” has been confirmed for complete root coverage.²³

Subepithelial connective tissue graft (SCTG) has place as a gold standard in multiple gingival recession. It has been concluded that several site-specific and technical factors influenced the middle and long-term results of root coverage.²⁴

There is lack of a research-based moment for initiating orthodontic tooth movement after periodontal therapy. The knowledge on periodontal wound healing dynamics may be considered the best (gold standard) ‘biologic starting point’ of orthodontic treatment after treatment of periodontitis.²⁵

It is proposed that laser be considered a new gold standard in treatment of periodontitis, the most common chronic inflammatory disease seen in humans.²⁶

Dental implants have become the gold standard at reconstruction of the missing dentition. Dental implants have reliable results in providing function and aesthetics with long-term success.²⁷

Chlorhexidine has been recognised as the primary agent for chemical plaque control since long. It is considered the gold standard antimicrobial agent against which the efficacy of other antimicrobial and antiplaque agents is assessed. Chlorhexidine has better persistence at tooth surface hence accounting for its better antiplaque effect. In spite of an apparent immediate effect on oral microorganisms, other antiseptics are not adsorbed and hence allow plaque to build up after they are removed. Other agents that show limited persistence are either bound to the surface in such a

way that they cannot interact with a bacterium (irreversible adsorption) or are lost from the tooth surface faster than chlorhexidine. Chlorhexidine covers gram-positive and gram-negative bacteria, yeasts, dermatophytes, and some lipophilic viruses.²⁸

EVIDENCE THAT SET GOLD STANDARDS IN PERIODONTICS

Evidence-based practice (EBP) has attracted the focus due to the increasing complexity of clinical dentistry and is considered the gold standard. Pierre Fauchard (1678 - 1761) might have introduced the concept of evidence in dentistry for the first time. Both Fauchard and James Lind (1716-1790) worried about the health of sailors dying of scurvy and did a 'clinical trial' of vitamin C to counteract the disease.²⁹

Russell's Periodontal Index (PI) pioneered assessments of the periodontal condition.³⁰ Gingival Index (GI) proposed by Loe in 1963 facilitated the collection and processing of data.³¹ Sigurd P. Ramjford integrated indices and gave Periodontal Disease Index (PDI).³² The user friendly classification of marginal tissue recession³³ and tooth mobility was presented by Miller.³⁴ The furcation measurement or grading system by Glickman was most widely used.³⁵

The close correlation between periodontal destruction and oral debris in clinical experiments and electron microscopic investigations has demonstrated an intimate anatomical relationship between the microorganisms of deposits and affected gingival tissues.³⁶ The individual rate of development of gingivitis closely correlated with the rate of plaque accumulation. The characteristic bacteriological changes were revealed in plaque along the gingival margin in 'Experimental gingivitis in man II'.³⁷

Periodontal disease natural history in man has described the initiation, rate of progression of periodontal disease and consequent tooth loss.³⁸ The association of number of possible pathogens, animal pathogenicity, and virulence factors has been demonstrated with disease. Factors which involved susceptibility of the individual host and the presence of interacting bacterial species promote or halt disease progression.³⁹ 'Microbial complexes in subgingival plaque' recognised that bacterial species exist in complexes in subgingival plaques.⁴⁰ Chronic infections fundamentally involve all bacterial biofilms. Their distinct phenotype makes them resistant to antibacterial agents, and their matrix makes them resistant to the antibacterial molecules.⁴¹ Early colonisation by periodontal pathogens demonstrated that susceptible individuals could be monitored using DNA probes.⁴²

Multipotent postnatal stem cells that could function in regeneration of periodontal tissue were found during investigation of the human periodontal ligament.⁴³ Identification of essential genes of the periodontal pathogen *Porphyromonas gingivalis* demonstrated that Gram-negative anaerobic bacterium was associated with periodontal disease onset and progression.⁴⁴

The highly significant research and development of osseointegrated implants by Branemark et al. led to great success of endosseous dental implants and retained prostheses over past decades.⁴⁵

The 1989 classification systems, extensively utilised by researchers and clinical scientists all over the world had multiple imperfections. The European classification of 1993 was flawed for the lack of detail practically required for comprehensive characterisation of the wide spectrum of diseases encountered in periodontal clinical practice. The 1996 World Workshop in Periodontics stressed on the requirement of a revised system of classification. In 1997, a committee to plan and organise a workshop to amend the classification system was formed by the American Academy of Periodontology. Following this, the International Workshop for a Classification of Periodontal Diseases and Conditions was held in 1999 and a new classification was agreed upon.⁴⁶ A new classification scheme for periodontitis was developed by the 2017 framework.⁴⁷

The information on the pathogenesis of periodontitis is not extensively covered by Gold standards for diagnosing the disease. The comparative evaluation of gene expression signatures between diseased and healthy gingival tissues may indeed be recognised as useful in the determination of pathobiological description of periodontitis and future studies.⁴⁸

Some accepted endpoints are frequently used as they are thought to be gold standards in measuring periodontal disease and the treatment outcomes.⁴⁹ The advent of personalised medicine has worked to focus clinical attention away from typical patients analysed by root canal treatments (RCTs). Gold standards, whether actual or figurative, represent structures of exchange and aspirations toward stability.⁵⁰

In summary, the dependable modalities of treatment are underway and some are already recognised as gold standards. Further research in the field might set new gold standards for the benefit of patients and practitioners in the field. The establishment of dependable clinical modalities used in the field and their comprehensive classification and

description can assist the practitioners as well as motivate them to engage in research regarding newer levels of standard that existing methods can be compared against. The presently available therapeutic tools directly link to the periodontal treatment outcome. Later advances in modalities of treatment have ensured that teeth that were considered periodontally hopeless in the past can now be managed and further maintained for an extensive duration of time with practical function and satisfaction on the patient's part.

LIMITATIONS

Critical analysis with future advancements in the field may necessitate systematic review of gold standards in

Periodontics. Extensive elaborations and analyses of all the Gold Standards could not be presented. Many Gold Standards are still to be set in the field and further efforts in association with experienced researches would be an important step in the future.

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