

Evidence-Based Periodontology: An Update on the Management of Periodontal Diseases

Rahul Bhandary¹, Geethu Venugopalan², Amitha Ramesh³, Nina Shenoy⁴, Shabeer Ahamed⁵, Putta Uday Simha⁶

Professor, Department of Periodontology, A.B Shetty Memorial Institute of Dental Sciences, Deralakatte, Mangalore-575018.

Resident, Department of Periodontology, A.B Shetty Memorial Institute of Dental Sciences, Deralakatte, Mangalore-575018

Professor and Head, Department of Periodontology, A.B Shetty Memorial Institute of Dental Sciences, Deralakatte, Mangalore-575018.

Professor, Department of Periodontology, A.B Shetty Memorial Institute of Dental Sciences, Deralakatte, Mangalore-575018.

Professor, Department of Periodontology, Malabar Dental College and Hospital, Manoor, Edapal Kerala.

Resident, Department of Periodontology, A.B Shetty Memorial Institute of Dental Sciences, Deralakatte, Mangalore-575018

Abstract

Background: The objective of Evidence-Based Periodontology is to enable the implementation of a scientific approach in clinical practice, thereby serving as a link between scientific research and clinical application. The purpose of this manuscript is to provide a comprehensive update on the best practices based on scientific studies and systematic reviews on the various treatment modalities in periodontology. It also demonstrates the potential of using an evidence-based approach to inform and improve healthcare practises in the field of periodontology. **Results:** The following conclusions were drawn based on the synthesized evidence from the systematic reviews-Nonsurgical Pocket Therapy (NST) yielded a favourable outcome, with the exception of pockets measuring less than 3mm in depth. There is a scarcity of definitive evidence concerning the effectiveness of adjunctive systemic antimicrobials and local drug administration for non-surgical management of periodontitis, especially in terms of long-term follow-up and the outcomes is predicated upon upon various clinical, operator as well as patient related factors. The efficacy of Open flap debridement for the management of chronic periodontitis has been discovered to be effective in terms of attachment level gain and reduction in gingival inflammation. Guided tissue regeneration has been found to yield more reliable and long-lasting clinical outcomes in comparison to access flap surgery in the treatment of two- or three-wall osseous defects and Class II furcations. Furthermore, the effectiveness of free gingival grafting (FGG) is significant, although it is contingent upon both the judicious selection of cases and the operator's level of expertise. **Conclusion:** Evidence-based periodontology offers cognitive benefits by expanding knowledge, strategic benefits by guiding decision-making, and instrumental benefits by supporting effective diagnostic and treatment approaches. By embracing evidence-based practices, clinicians can elevate the quality of patient care and contribute to advancements in the field.

Keywords: Evidence based practice, Evidence based periodontology, non-surgical periodontal therapy, Periodontitis

Address for correspondence: Dr. Geethu Venugopalan, Junior Resident, Department of Periodontology, A.B Shetty Memorial Institute of Dental Sciences, Deralakatte, Mangalore-575018 India. Email Id: drgeethuv@gmail.com Phone: +91- 8431947690

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Introduction

Periodontology is not just a science but also an art. The scientific method, which encompasses both basic and applied studies as well as clinical trials, forms the foundation of this field, making it a true science.¹ Furthermore, it can be considered an art form as it heavily relies on the clinician's personal observation and experience, as the scientific field is limited in its ability to fully comprehend the complexity of all variables involved in a particular scenario.

The amalgamation of scientific comprehension and clinical observation forms the foundation for significant dental care.

1.1 Period before evidence-based Periodontology

The field of periodontology boasts a wealth of historical and scholarly inquiry. A cursory exploration of the MEDLINE database utilizing the search terms "Periodontal Diseases" or "Periodontitis" exclusively, spanning the years 1966 to 2003, yields in excess of 45,000 results.² Consequently, the optimal utilization of this vast pool of research information must be integrated into the practice of periodontology. The objective of periodontology which is based on evidence is to enable a methodical approach, hastening the integration of the most superior research into the treatment of patients.³

Prior to the influence of evidence-based periodontology (EBP) on clinical practice, expert advice was the primary source of guidance, often based on physiological reasoning and the personal experience of individual clinicians. The prioritization of this particular aspect led to a notable disparity between the existing empirical data and the practical implementation in clinical settings.^{1,4}

The Notion of Evidence-Based Periodontology

The concept of Evidence-based Periodontology involves the integration and analysis of current research evidence with individual expertise, enabling dental professionals to make informed decisions that improve clinical practise.³ The vast and substantial accumulation of knowledge on periodontics over time has provided a rationale for the identification of the most efficacious course of treatment for patients.

The field of periodontics is experiencing swift development, marked by improvements in the ability to identify and prevent disease, slow its advancement, and restore lost periodontal tissue. There has been a recent focus on the process of clinical decision-making, and it is incumbent upon us to deliver optimal evidence-based treatment to our patients. The field of periodontology that is based on evidence serves as a connection between scientific research and clinical application, allowing academic researchers to stay up-to-date with the latest developments in the healthcare industry.⁴

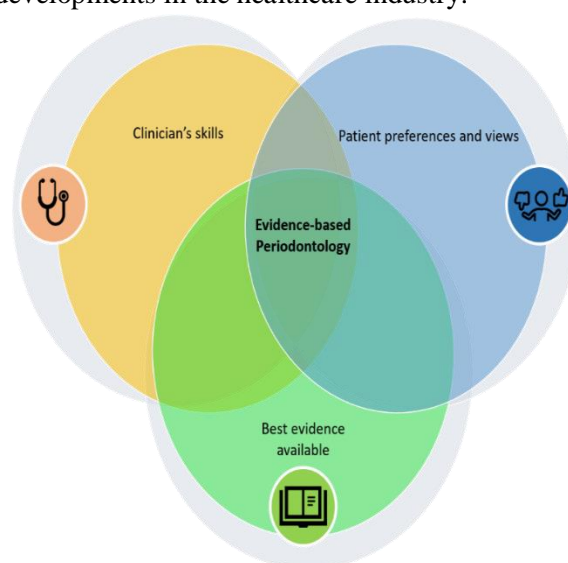


Figure 1: Inter-relationship between different constituents of EBP

2.1 Advantages^{3,4}

- Objective.
- Reliable in terms of science.
- Patient-focused
- The incorporation of clinical experience is observed.
- Emphasises the importance of exercising sound and rational decision-making skills.
- The work is characterized by a high level of completeness and inclusiveness.
- The methodology employed is transparent.

Evidence-Based Periodontology: Progressive Outcome

Cognitive use:

Use of evidence as enlightenment or change in one's own way of thinking. Sample outcomes of cognitive use⁵:

The acknowledgment of a substantiated (or refuted) foundation for a present methodology based on scientific suitability: for instance, "I am now mindful that the actions I am undertaking (or decisions I am arriving at) for these individuals are (or are not) fitting and established through research."

There is a heightened level of consciousness regarding a particular matter, concern, or state, as exemplified by statements such as "I am more attentive to the previous experiences of my patients" or "I had believed my approach was successful until I reviewed the quality report."

Enhanced comprehension or recognition of the specific ailment(s) or encounter(s), such as "My perspective towards this category of patients has undergone a complete transformation."

The acquisition of enhanced knowledge or skill pertaining to a specific issue, problem, or condition is exemplified by the statement, "I have now incorporated additional strategies for management or assessment skills into my skillset."

The reconceptualization of a set of (or awareness of) presumptions concerning practices, policies, or methods as a result of evidence acting as a definite catalyst.

Strategic use:

The utilization of evidence to validate a policy or a pre-existing perspective on with the intention of persuading others to adopt a new perspective or take action.

Sample outcomes^{6,7}:

A discourse aimed at persuading a peer or any other individual to modify their conventional and unfounded practice or belief.

Preparation and delivery of an Evidence-based paper, position paper, or reform proposal to a governing or important organization.

The utilization of regional audit or benchmark data as a means to promote consciousness or self-evaluation of present practices and/or implementation of Evidence-based guidelines.

Instrumental use:

The utilization of evidence can be observed in a tangible and observable way that demonstrates a modification in an individual's conduct or performance. Alternatively, evidence can be employed in a manner that is intended to prompt or necessitate a transformation in the behavior or performance of individuals, often through the implementation of institutional mechanisms or procedures^{5,6,7}.

The process involving an individual's behavioral modification, leading to the adoption of a new Evidence-based practice and/or cessation of a previously unsupported practice, can be observed. For instance,

- A method of evaluation
- A potential clinical intervention modality.
- A pedagogical approach
- An approach that is focused on management and leadership principles.
- A clinician adopting a newly suggested or announced practice, policy, process, algorithm, etc

The implementation of a structured approach, such as an E-B policy, procedure, assessment tool, guideline, detailed protocol, algorithm, program, or other plan for action, in a formal manner.

A systematic assessment of the present methodology utilizing E-B variables and measurement instruments.

Re-designing the roles, systems, or other operational entities of an organization.

EBP Overall Outcomes:

Patient/Family: Realization of best practice results in relation to:

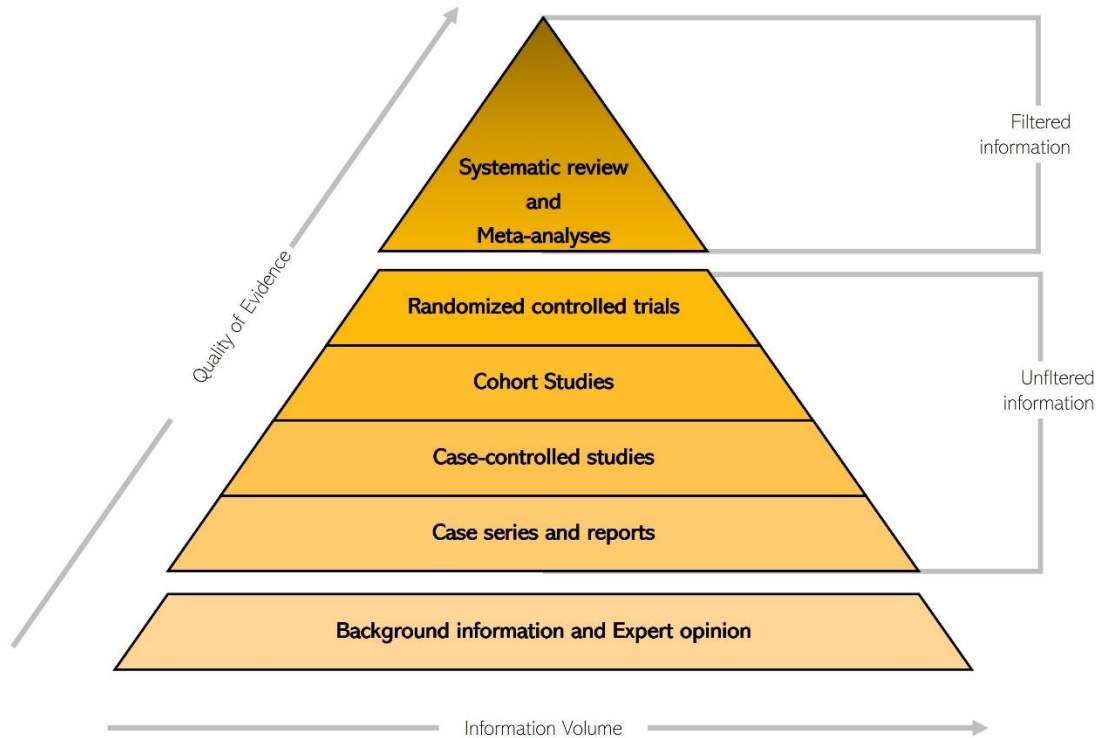
- Patient knowledge, skills, and readiness
- Morbidity and mortality
- The severity of the symptoms;
- Patient satisfaction;
- Reduction of risk;
- Reduction of error, adverse event, or potential complication

For the medical professional:

Problem/issue resolution or attainment of the best training/management/other results in terms of clinical expertise, cost-effective treatment, and program

Study Designs and Critical Appraisal

Figure 2: Diagram showing the Level of validity and confidence of outcomes according to study



former is deemed to be of inferior quality. The allocation of treatment in these trials is randomized.^{9,10,11} The aforementioned trials aim

type and design.

Level 1:

This group includes meta-analyses, high-quality systematic reviews, and clinical practice guidelines. Clinical practice guidelines are directives created specifically to help patients and healthcare workers receive the best care possible for particular clinical conditions.^{8,9} These suggestions are based on the most rigorous scientific evidence that is currently available, including systematic reviews and meta-analyses. A team of experts examines the data and impartially develops the recommendations. These rules might need to be adjusted over time as the corpus of data changes.¹⁰

Level 2

Level 2 evidence is characterized by research that is considered to be underpowered, indicating that the sample size may not have been adequate to identify a statistically significant distinction. Level 2 evidence, akin to its counterpart level 1 evidence, emanates from randomized clinical trials. Nonetheless, the

to evaluate and contrast the results achieved by individuals who are subjected to a particular treatment regimen with those who do not receive any form of therapy. Randomized controlled trials (RCTs) are classified as level 2 evidence when they exhibit unacceptably high levels of Type I and Type II error. Level 2 evidence encompasses research studies such as prospective comparative investigations and retrospective analyses.¹¹

Level 3:

Data at Level 3 is generated through clinical trials that were conducted under controlled conditions but lacked randomization. In these investigations, the researcher compares the outcomes of a specific treatment administered to a test group of patients to the outcomes of the treatment administered to the control group.¹¹ The causative factor behind the differences in outcomes remains ambiguous, as it is uncertain whether they are attributable to the treatment or an imbalanced variable existing between the two groups. The third tier of investigations encompasses various research methodologies, such as case-control studies that examine

diagnostic and prognostic factors, retrospective comparative studies, and systematic reviews.^{11,12}

Level 4:

Level 4 evidence comprises of a solitary case, a series of cases, a case-control study (pertaining to diagnostic studies), a reference standard that is weak, or an analysis that lacks a sensitivity analysis. In a case-series study, the investigator delineates the reactions of a sequence of patients to a specific intervention.^{12, 13}

Level 5:

This pertains to the weakest form of evidence, which originates from case reports detailing interventions and/or expert viewpoints. Interventional studies entail the application of a distinct therapeutic regimen to an individual participant, while systematically recording the outcomes. The objective of such research endeavors is frequently to delineate a distinct therapeutic intervention. The primary limitation of these studies lies in the inability of the reader to ascertain the generalizability of the treatment outcomes to other individuals who undergo the same treatment.^{12,13}

5.2 Critical Appraisal

The process of critically appraising involves a systematic evaluation of the strengths and weaknesses of a particular piece of information or research. It requires a thorough analysis of the methodology, data collection, and interpretation of results. The purpose of critical appraisal is to assess the validity and reliability of the information and to determine its relevance and applicability to a particular context. To effectively conduct a critical appraisal, one must possess a sound understanding of research methods and statistical analysis.^{14,15}

In the process of evaluating the quality of a study, it is imperative to take into account the various factors that could potentially impact its outcome. The variations in question are bound to be contingent upon both the subject matter of the primary investigation and the designs of the respective studies.¹⁶

Given the variability of employment circumstances, it is not feasible to formulate a singular system that would be universally suitable for all situations. Typically, it is necessary to evaluate the domains of bias,

confounding, and chance as part of the assessment process.¹⁷

Several reviewers have endeavored to create composite scales that assign scores to the different domains of quality. Subsequently, the aforementioned scores are aggregated to generate a comprehensive summary metric for the entire study. There exist issues associated with this particular methodology. Numerous high-caliber items may lack empirical substantiation, and the assigned scores for each item are bound to be subjective.^{17,18} The adequacy of an overall assessment of a particular study's quality through a single summary score is questionable. The application of distinct composite scales to identical studies may result in varying scores and rankings. Due to the aforementioned reasons, composite scales have become less popular in recent times. A different methodology involves evaluating each individual aspect of quality in isolation. In order to conduct thorough and rigorous systematic reviews, it is common practice for independent reviewers to perform quality appraisal in duplicate. To facilitate this process, checklists are often utilised.¹⁸

6. Evidence-Based Approach in Periodontal Therapy

Search methods

This study incorporated high-quality, meticulous systematic reviews obtained via an electronic search of PubMed/MEDLINE, Web of Science, and the Cochrane Library, with a focus on English language publications. A systematic exploration was carried out across five distinct databases. No limitations were imposed on the publication date in any manner. A total of 39 articles were included and 104 articles were excluded. The inclusion criteria were systematic reviews of Randomized Controlled clinical trials with a follow-up period of a minimum of 4 weeks, the medium of communication is English, and the outcomes of the study have been reported in an unbiased and consistent manner. The search excluded systematic reviews on In-vitro and in-vivo studies, studies that had a follow-up period of 2 weeks or less, poor sample size and study design.

6.1 Evidence-Based Approach and Nonsurgical Periodontal Therapy

The present study conducted a systematic search of nine reviews to identify the most robust evidence available. The keywords used were non-surgical periodontal treatment; pocket closure; residual pockets; scaling and root planning, non-surgical therapy; periodontitis; systemic antibiotics, amoxicillin; diabetes mellitus; metronidazole.

The search yielded a total of nine systematic reviews, which were examined to identify the most compelling evidence. The following conclusions/ assumptions were drawn following a review of the nine articles^{19,20, 21,22,23,24,25,26}.

It was found that Nonsurgical Pocket Therapy (NST) had a beneficial impact, except for pockets that were less than 3mm in depth.

According to the findings of a systematic review and meta-analysis by Citterio F et al., non-surgical therapy (NST) has demonstrated a capacity to effectively eliminate a significant proportion of periodontal pockets. Notwithstanding, it is imperative to exercise prudence when contemplating residual pockets subsequent to NST, and deliberate on the need for additional treatment.²⁷

The implementation of NST procedures has been shown to significantly enhance the quality of life pertaining to oral health in a relatively brief period of time, with the benefits persisting for a minimum of three months post-treatment.

Drawing upon clinical and patient-centered metrics, it is advisable to consider non-invasive periodontal therapy as a preeminent modality for improving patient outcomes, mitigating comorbidities, and augmenting patient welfare both in the short and long term.

6.2 The utilization of adjunctive therapies during the initial phase of treatment:

6.2.1 Systemic Antibiotic therapy and periodontitis:

The administration of systemic antibiotics in conjunction with scaling and root planning has become the prevailing practice in the treatment of both aggressive and non-responsive variants of periodontitis. The determination to administer a systemic antibiotic is contingent upon the patient's medical and dental records.²⁸

Keywords: amoxicillin; diabetes mellitus; metronidazole; non-surgical therapy; periodontitis; systemic antibiotics.

Several systematic reviews yielded several conclusions regarding the impact of systemic antimicrobials as a supplementary measure to SRP in the management of periodontitis among patients undergoing non-surgical treatment which can be summarized below^{29,30,31,32,33,34,35,36}.

There exists a dearth of conclusive evidence regarding the efficacy of adjunctive systemic antimicrobials for non-surgical treatment of periodontitis, particularly with regard to long-term follow-up.

This lack of certainty makes it difficult for clinicians and patients to make informed decisions regarding the use of such antimicrobials.

Although no significant adverse events were reported in any of the trials, it is important to inform patients about the commonly observed adverse events associated with these medications.

Systemic amoxicillin-metronidazole was found to be effective in managing periodontitis in patients who were systemically healthy by enhancing clinical periodontal parameters and diminishing periodontal-pathogenic microorganisms present in the subgingival biofilm.

Nevertheless, the available evidence regarding the prescription of this drug combination to individuals with diabetes is inadequate.

The utilization of antibiotics in conjunction with non-surgical periodontal therapy may yield a favorable impact on systemic inflammation levels and glycemic control in individuals with diabetes, albeit only in the short term.

6.2.2 Local Drug Delivery:

Administering antimicrobial agents directly to the site of infection offers several benefits over systemic antibiotics, such as reduced incidence of adverse reactions and non-adherence concerns. Generally speaking, adjunctive therapies that exhibit user-friendliness, consistent retention at the point of application, and gradual, consistent discharge of substantial amounts of antimicrobial agents have gained widespread acceptance.

A total of 7 systematic reviews and meta-analyses were reviewed and the following conclusions were drawn^{37,38,39,40,41,42,43} :

The use of adjunctive therapies such as minocycline (MINO) gel, microencapsulated MINO, CHX chip, and doxycycline (DOXY) gel during scaling and root planning (SRP) has shown a significant reduction in periodontal disease (PD) and clinical attachment level (CAL) gain when compared to SRP alone.

Gel preparations that do not form a solid structure have exhibited unsatisfactory performance, possibly attributable to unfavorable release kinetics.

The utilization of antimicrobials as a supplementary treatment to scaling and root planning has demonstrated limited but significant clinical advantages in the short term. Randomized controlled trials have provided empirical evidence that tetracycline fibers, chlorhexidine chips, minocycline microspheres, and doxycycline gel possess advantageous pharmacodynamics. The utilization of the aforementioned in the early phase of therapeutic intervention has demonstrated noteworthy advancements in the reduction of probing depth and gains in clinical attachment level in certain instances, as supported by statistical data.

The cost-benefit ratio lacks empirical evidence.

At present, the predominant recommendation for localized antimicrobial intervention is in individuals with chronic periodontitis who exhibit isolated pockets of moderate severity that have not demonstrated a favorable response to mechanical therapy in isolation.

The efficacy of locally applied antibiotics in terms of reducing probing depth or gaining clinical attachment was frequently observed to be minimal, typically in the range of tenths of millimeters.

There exists a discrepancy in the available data regarding the efficacy of localized drug administration in augmenting the outcomes of scaling and root planning (SRP) in cases of deep probing sites. Additionally, there is a dearth of information regarding its potential to impede the advancement of disease or improve osseous regeneration in instances of infrabony defects.

The consensus among the various studies is that the determination to employ local drug delivery during either active treatment or maintenance is contingent upon clinical observations,

documented therapeutic responses, intended clinical endpoints, and the patient's dental and medical background.

The findings of Chambrone et al.'s systematic review indicate that the use of local antimicrobials as an adjunct to non-surgical periodontal therapy is effective in reducing pocket depth (PD) and improving clinical attachment level (CAL) in smokers with chronic periodontitis (CP) who present with PD ≥ 5 mm prior to treatment. The existing evidence does not indicate comparable benefits in cases where scaling and root planning are combined with systemic antimicrobial/antibiotic therapy.

The utilization of local antimicrobials as a supplementary treatment to scaling and root planning (SRP) may yield advantages in terms of pocket depth reduction and clinical attachment level gain in patients with both diabetes mellitus and chronic periodontitis, particularly in individuals with well-managed diabetes and in deep periodontal pockets.

Nevertheless, the majority of systematic reviews have indicated that the extent of the alterations is of uncertain clinical significance.

6.3 Evidence-Based Approach in Periodontal Regeneration

The clinical technique known as guided tissue regeneration involves the use of resorbable and non-resorbable barrier membranes to selectively isolate the epithelium and gingival connective tissues, thereby facilitating the re-population of cells from the periodontal ligament, cementum, and bone^{44,45}.

The findings derived from multiple systematic reviews can be summarized as follows^{46,47,48,49,50,51} :

Guided tissue regeneration has been found to yield more reliable and long-lasting clinical outcomes compared to access flap surgery in the treatment of two- or three-wall osseous defects and Class II furcations.

GTR exhibited greater efficacy than OFD in enhancing attachment levels. Nevertheless, significant variability was observed among the studies, and as a result, the clinical advantages of guided tissue regeneration (GTR) are restricted by this heterogeneity.

clinical benefits observed for bone grafting and/or guided tissue regeneration in both intra-

bony defects and buccal Class II furcation involvements.

The outcomes of regenerative procedures are influenced by the level of intensive post-operative care provided.

The findings suggest that root conditioning performed during surgical exposure does not yield noteworthy enhancements in periodontal regeneration. Its clinical benefits are limited to the elimination of a smear layer.

According to long-term studies, the clinical benefits following guided tissue regeneration (GTR) can be sustained over an extended period, as long as proper oral hygiene practices and suitable recall program are upheld. T

The utilization of growth and differentiation factors in the guided tissue regeneration (GTR) therapy for periodontal defects is anticipated to yield enhanced clinical outcomes.

6.4 EBP and Mucogingival Surgery 52,53,54,55,56

The efficacy of FGG is significant, albeit contingent upon both the judicious selection of cases and the operator's level of expertise.

Each of the primary periodontal plastic surgery techniques yields enhancements in initial clinical parameters.

Subepithelial connective tissue grafts, whether performed in isolation or in conjunction with coronally advanced flaps, produce more favorable outcomes in terms of complete root coverage, long-term stability, and greater augmentation of keratinized tissue.

Despite this, coronally advanced flaps, whether utilized in conjunction with biomaterials such as acellular dermal matrix grafts, enamel derivative proteins, and xenogeneic collagen matrix or employed independently, yield satisfactory outcomes and are appropriate as secondary or alternative procedures to subepithelial connective tissue grafts.

6.5 EBP and Open Flap Debridement 58,59,60,61

The efficacy of both scaling and root planing (SRP) as a standalone treatment and SRP in combination with flap procedure for the management of chronic periodontitis has been established. These methods have been found to be effective in terms of attachment level gain and reduction in gingival inflammation.

The use of adjunctive antimicrobial agents with OFD was found to be associated with a significant reduction in pocket depth (PD) in cases involving deep and moderate pockets.

Open flap debridement is a more effective treatment option for deep pockets, as it leads to a greater reduction in probing pocket depth and clinical attachment gain.

The utilization of barrier membranes in conjunction with grafting materials has the potential to yield histological indications of periodontal regeneration, with a primary focus on the repair of bone tissue.

7. Clinical Significance:

The practice of evidence-based periodontology involves utilizing scientific evidence that is pertinent to a patient's condition, while taking into account the patient's values and utilizing the clinical judgement of the dentist to customize treatment for the patient⁶². The primary objective is to enhance periodontal treatment outcomes by relying on the most superior quality evidence that is accessible. Upon implementation of the intervention, it is imperative to conduct a re-evaluation of the outcome within the framework of the clinical inquiry to ascertain the resultant impact. The method can be extended to a population to produce evidence-based recommendations for the population. The grading of population recommendations is commonly determined by the scientific basis that supports the guidelines. There are multiple grading systems in existence. These classification systems categorize recommendations based on the strength of evidence available to support the guidelines, ranging from robust evidence to weak or absent evidence, with intermediate levels of support in between.^{62,63}

Conclusion

Evidence-based periodontology (EBP) refers to the deliberate and systematic utilization of contemporary, high-quality evidence in the process of determining the most appropriate course of treatment for individual patients. This approach is characterized by its judicious and rational application of the best available evidence. This particular publication does not comprise a compendium of culinary instructions; however, its proficient

implementation yields a financially prudent and superior healthcare outcome. The primary objective is for the periodontist to select the most effective solution for their patient by utilizing the highest quality evidence available, with the ultimate goal of delivering optimal healthcare across all domains. Additionally, it is utilized to prevent significant errors during the treatment process, thereby enhancing the standard of healthcare delivered to the patient. In a broader perspective, it has the potential to enhance the periodontal health of patients while also improving their aesthetic outcomes. The implementation of evidence-based practice (EBP) necessitates that physicians acquire novel knowledge, including proficiency in the English language and computer literacy. These competencies enable access to medical and dental databases, facilitate the exploration of medical literature, and foster fundamental skills in the interpretation of epidemiological and statistical findings. After acquiring proficiency in the search methodology and application of evidence-based practice, healthcare professionals can benefit from a valuable tool in their daily practice. The utilization of evidence-based practice (EBP) by physicians is essential for obtaining reliable information. This approach not only saves time but also enhances the physician's proficiency and the quality of medical services provided, leading to increased satisfaction among healthcare professionals.

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