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COMMENTARY

Biologically guided implant therapy: A diagnostic and therapeutic strategy of conservation and preservation based on periodontal staging and grading

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Abstract

Biologically guided implant therapy is based on the new periodontitis classification system recently released by the American Academy of Periodontology and the European Federation of Periodontology that uses staging and grading for the diagnosis of periodontitis. This paper proposes that periodontitis staging and grading should be used in dental implant therapy as a means to ensure maximum conservation of teeth and maximum preservation of alveolar bone. These biologic principles should guide the treatment planning process and supersede a mechanically based, restoratively driven rationale that should be secondary to the biologic principles of conservation and preservation but part of the collaborative treatment planning process. And treatment alternatives throughout the patient's lifetime should be provided for in case of prosthesis loss due to peri-implantitis. The use of grading will help with recognition of systemic aspects that can have a negative impact.

KEYWORDS

dental implants, peri-implantitis, periodontal medicine, periodontics

1 | INTRODUCTION

The key to understanding the role of dental implants is to recognize that they are an option for tooth replacement and not a means to treat dental or periodontal diseases. Thus they may be valuable additions in treatment planning in three broad situations: 1) in non-periodontitis patients where teeth are lost to dental diseases, trauma or their sequelae; 2) in periodontitis patients where teeth have been lost to periodontal disease but the remaining teeth are maintainable from restorative or periodontal aspects; and 3) in patients where there are both dental and periodontal reasons for tooth replacement. It is important for clinicians to: 1) recognize the biologic context in which the implants will function; and 2) properly evaluate the severity of the periodontitis and the complexity of managing it through either tooth retention treatments or tooth replacement with implants, when appropriate.

2 | COMMENTARY

The American Academy of Periodontology and the European Federation of Periodontology recently held a joint workshop aimed at developing a new system of diagnosis and classification of periodontal diseases. The portion of the workshop dedicated to periodontitis recommended a system of disease staging and grading to capture more dimensions of each patient's clinical disease and maximize the significance of the diagnostic process in overall treatment planning and therapy.[1] Staging focuses on diagnosis of the primary disease, in this case periodontitis, and includes an assessment of case severity and complexity that furnishes information to help guide treatment. Grading, on the other hand, focuses on the systemic environment and how it affects, and is affected by, periodontitis. It also guides patient management, which may involve medical cotherapists and/or require greater post-treatment efforts to control inflammation and inflammatory/microbial agents that

flow into the systemic circulation. Thus staging and grading of periodontitis, in essence, provides a clinical diagnosis of periodontitis within the context of the whole body. Systemic diseases that affect periodontitis are taken into account and the impact of periodontitis as a comorbidity affecting systemic diseases is also assessed. **This system of contextual whole body diagnosis considers not only the principle disease but also peripheral influences flowing both to and from the diseased periodontium.** The advantage of this "big picture" diagnosis is to provide a more complete understanding of all aspects of the disease and an improved ability to communicate regarding the total context of periodontitis within the human body. Thus, periodontal staging and grading uses the principles of precision medicine in arriving at a periodontal diagnosis that will be tailored to each patient's specific therapeutic needs. While there is still much to learn, especially with regard to the effect of periodontitis on systemic diseases, this system can help guide future research and lead to better control and prevention of comorbid effects. Most importantly, communication is improved thereby giving the patient a more complete understanding of all aspects of the primary disease and its bidirectional complicating influences. And it is a valuable tool to facilitate communication and understanding with other medical or dental professionals.

The new system of periodontal diagnosis staging, and grading is profoundly significant for implant diagnosis, treatment planning, and therapy. It should be the beginning of every implant case, dentulous or edentulous, irrespective of the perceived periodontal status. Implants should be viewed as a supplement to the existing teeth and used to help maintain the patient in a fully functional dentition throughout their lifetime. Implant availability should not be considered a valid reason to edentulate a patient and use implants as a preferred, total substitute for the natural dentition. Dental implants are not a superior alternative to a functioning natural dentition but are useful as replacements when teeth are removed for valid periodontal, restorative, or developmental reasons. Conservation of the maximum number of viable, useful natural teeth is of paramount importance to the patient's overall dental health.

The initial step in implant diagnosis and treatment should be a complete periodontal examination and diagnosis using staging and grading. The grading component of the periodontal examination provides a biologic framework to help the clinician assess the patient's needs within her/his overall health context. This is critical to overall treatment planning and should serve as the primary means to determine the health, retainability, and value of the natural teeth within a functional dentition. Treatment options should be formulated for incorporating implants as supplements to the natural dentition. And contingency plans should be developed to provide alternatives in case of implant or tooth failure. Given the relatively high incidence of peri-implantitis, alternatives are essential. The average lifespan of a dental implant has not been established but, in light of the increasing incidence of peri-implantitis, this information is essential to guide treatment planning and to inform the patient that implant failure and loss do occur. A recent systematic review reported up to a 47% prevalence of peri-implantitis at a patient level (with a mean prevalence of 21.7%).[2] And a consensus statement recommended that patients with a history of periodontitis should be informed before tooth extraction and implant placement that they are at higher risk of developing peri-implantitis.[3] Biologically guided periodontal/implant diagnosis and treatment planning should be the first step in implant therapy. Once the overall plan is determined, there should be collaboration with the restorative dentist to design the restoratively directed portion of treatment. This allows the various restorative options to be weighed according to their advantages, disadvantages and compatibility with a biologically guided treatment plan. The advantage of this sequence is that ultimately a strong biologic foundation is provided to support lasting therapeutic success.

The contextual whole-body diagnosis of periodontitis will also take into account the results of grading, which will identify key systemic risk factors such as diabetes and smoking. In general, the systemic risk indicators for implant placement are similar to those for periodontitis and will be revealed by the periodontal diagnosis.[4] They need to be discussed with the patient and restorative dentist so that all parties are aware of the potential for implant failure/loss and the need for alternative treatment plans if implant failure/loss occurs. Tooth loss could also occur; however, proper periodontal treatment planning, treatment, and maintenance can predictably maintain the teeth in health. Periodontal/implant maintenance can help reduce the incidence of peri-implantitis. It also can help prevent recurrent periodontitis, which is important, since inadequately controlled periodontitis increases the risk of peri-implant complications.[3]

Template-style treatment plans that call for routine extraction of all teeth and replacement with implants often require severe reduction of the remaining alveolar bone. This reduction is needed to create restorative space for vertically large implant-supported prostheses that are excessive space consumers and cannot co-exist with normal alveolar ridge height. The greater the vertical dimension of the prosthesis the greater the amount of bone sacrifice required. This severe bone reduction destroys normal anatomy and may limit treatment alternatives if the implants are lost to peri-implant diseases/conditions such as peri-implantitis, especially at an advanced age. Vertically large space-consuming appliances are a viable alternative treatment when necessary but should be used judiciously. They are primarily indicated when adequate restorative space is already present due to the extensive bone loss seen in long-term denture patients or in patients with severe periodontal bone loss. Otherwise space-conserving restorations should be preferred thereby allowing preservation of the alveolar bone and, more importantly, treatment

alternatives in case of implant failure. The lack of treatment alternatives in elderly patients, due to previous severe bone reduction, could lead to the patient becoming a dental cripple later in life. Conservation of teeth and preservation or regeneration of alveolar bone are the guiding principles of periodontal treatment and should also be the guiding principles of dental implant therapy for both dentulous and edentulous patients. Using these biologic principles will maximize the long-term patient benefit from dental implant treatment.

Preservation of bone is also important during routine dental care. Tooth extraction techniques should favor tooth sectioning rather than traumatic extraction methods that remove an excessive amount of bone and destroy residual ridge volume and anatomy. Patients that suffer these inappropriate treatments often cannot receive dental implant treatment without undergoing complex bone grafting techniques to regenerate lost bone. Therefore, extraction sites should receive ridge preservation grafting, especially in the esthetic zone, to reduce bone resorption and modify the bone modeling process in favor of maintaining normal ridge anatomy.[5] Observing these biologic principles preserves the patient's bone and ridge anatomy thereby providing conditions more conducive to implant placement that should also reduce the need for additional ridge augmentation grafting. And early extraction is not a valid method to preserve alveolar bone. The deceptive allure of this false logic is that extraction is easy and will permanently eliminate periodontal bone loss when, in fact, it will lead to greater bone loss due to post-extraction bone modeling.[6] All that is needed is periodontal treatment. Previous studies have clearly shown that even periodontally hopeless teeth will not adversely affect neighboring teeth and bone levels as long as treatment is provided.[7,8] The real indication for extraction is when non-periodontal causes of bone destruction such as extensive endodontic lesions or vertical root fracture are present and bone loss cannot be contained.

The importance of the grading aspect of periodontal diagnosis should be emphasized since it highlights the impact of systemic influences. Thus diseases affecting the periodontium such as diabetes or smoking are evaluated to determine the level of diabetes control or the amount of smoking in packs per day. The better the diabetes control in terms of HbA1c level and the lower the amount of smoking, then the better the prognosis for a successful outcome. On the other hand, very poorly controlled diabetes or a very high level of smoking, such as 2 to 3 packs per day, may compromise healing to the point that surgical procedures should not be attempted. The patient needs to be informed of the surgical compromises and advised when appropriate consultation with a medical cotherapist should be sought to gain proper control of the diabetes or assist with smoking cessation. A well-informed patient may be more likely to comply with needed cotherapy or, if not, then withholding implant therapy may be in the best interest of the patient rather than creating a non-healing wound or placing an implant that is likely to fail.

Grading also encourages assessment of the level of inflammation to help determine when periodontitis might act as an inflammatory/microbial comorbidity for systemic diseases. Thus a high level of inflammation and pocket wall ulceration could lead to entry of inflammatory/microbial agents into the systemic circulation. This periodontal inflammation, when combined with inflammation from other diseases such as obesity or diabetes, could further elevate the serum C-reactive protein level and raise the level of risk for injury to the vascular intima thereby potentially impacting cardiovascular events such as heart attack and stroke. This means that the inflammation surrounding teeth and dental implants should be controlled to the maximum extent possible with a more closely monitored periodontal maintenance program. Thus it is important to consider implant treatment, like periodontal treatment, as a long-term therapy and not a single surgical event. To do so leaves the implants at risk of peri-implantitis and the patient at risk of potential systemic comorbidity effects from inflammatory/microbial agents.

3 | SUMMARY

Biologically-guided implant therapy means that an appropriate staging and grading diagnosis should take place to ensure that treatment planning emphasizes maximum conservation of teeth and maximum preservation of alveolar bone. These biologic principles should dominate the treatment planning process, not a restoratively driven, mechanically based rationale that can lead to excessive and unnecessary sacrifice of teeth and alveolar bone. While restorative considerations are important they must be incorporated into a sound collaborative periodontal/implant treatment plan and restorative factors should be secondary and complementary to a biologic treatment plan emphasizing conservation and preservation. Even cases presumed to be periodontally healthy should undergo a full periodontal examination to rule out undiagnosed periodontitis, caries, and other dental needs to ensure that all teeth receive appropriate treatment based on objective information. The infancy of dental implant therapy has been an exciting time filled with rapid change, increased research, an expanding evidence base, and a virtually miraculous change in tooth-replacement options. Hopefully clinical maturity will bring a wiser, more seasoned, more cautious treatment approach where sound biologic principles will serve as a foundation for a lifetime treatment strategy that will provide alternatives for patients of all ages.

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REFERENCES

1. Tonetti MS, Greenwell H, Kornman KS. Staging and grading of periodontitis: framework and proposal of a new classification and case definition. *J Periodontol*. 2018;89(Suppl 1):S159–S172.
2. Derks J, Tomasi C. Peri-implant health and disease. A systematic review of current epidemiology. *J Clin Periodontol*. 2015;42(Suppl 16):S158–S171.
3. Lindhe J, Meyle J. Peri-implant diseases: consensus report of the sixth European workshop on periodontology. *J Clin Periodontol*. 2008;35(Suppl 8):282–285.
4. Schwarz F, Derks J, Monje A, Wang H-L. Peri-implantitis. *J Periodontol*. 2018;89(Suppl 1):S267–S290.
5. Poulias E, Greenwell H, Hill M, et al. Ridge preservation comparing socket allograft alone to socket allograft plus overlay xenograft: a clinical and histologic study in humans. *J Periodontol*. 2013;84:1567–1575.
6. Araujo MG, Lindhe J. Dimensional ridge alterations following tooth extraction. An experimental study in the dog. *J Clin Periodontol*. 2005;32:212–218.
7. Machtei EE, Zubery Y, Yehuda AB, Soskolne WA. Proximal bone loss adjacent to periodontally hopeless teeth with and without extraction. *J Periodontol*. 1989;60:512–515.
8. DeVore CH, Beck FM, Horton JE. Retained "hopeless" teeth. Effects on the proximal periodontium of adjacent teeth. *J Periodontol*. 1988;59:647–651.

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