

Commentary on Resonance Frequency Analysis

Sreenivas Koka, DDS, MS, PhD
 Consultant, Division of Prosthodontics
 Associate Professor, Mayo School of Medicine
 Mayo Clinic, Rochester, Minnesota, USA
 Fax: 507-284-8082
 E-mail: koka.sreenivas@mayo.edu

Resonance frequency analysis (RFA) was first proposed for use in implant dentistry by Meredith and his colleagues.¹ Their preliminary investigations demonstrated that “resonance frequency measurements may be used to detect changes in implant stiffness and the exposed fixture height in vitro,” and radiography and histology were proposed as in vivo correlates. The initial excitement that accompanied RFA introduction was largely due to the perceived potential for meaningful clinical research utilizing this technology. The subsequent commercially available measurement system (Osstell) provided clinicians with an objectively determined implant stability quotient (ISQ), which quite encouragingly appeared to correlate reasonably well with subjective assessments of bone quality. Furthermore, endorsement of the RFA concept and support for research into its use came from several highly respected sources. Now, over 10 years since opening night, it is appropriate to review the performance of RFA in order to speculate whether audiences will be justified in seeking a front-row seat.

Dentists need methods, preferably a specific test or tests, that prognosticate implant survival at the time of implant placement, prior to subsequent prosthodontic management, and at different future times during recall assessments. Clearly, a tool that provides diagnostic information during healing and/or after loading that is both specific and sensitive for implant survival would greatly improve the quality of care. Such a tool is now particularly needed as more advanced and even adventurous therapies are sought for those clinical situations that challenge traditional notions of the “ideal.” RFA, unfairly or not, was heralded as precisely such a tool. Yet its original purported claims failed to measure

up to the expectation of compelling clinical results. Regrettably, ISQs as an outcome measure do not provide prognostic and/or diagnostic information. In most studies where ISQ values are recorded, such as that presented here by Östman and colleagues, the information is essentially presented in descriptive terms with very little evidence to correlate values to meaningful clinical outcomes. In contrast, Nedir et al² are to be commended for their investigation as to whether ISQ values can be used to predict osseointegration. Encouragingly, these authors were able to assign cut-off ISQ values above which osseointegration was likely to ensue. However, the clinical superiority of using ISQs in this manner over that obtained from surgical experience and tactile sensation of bone quality and bone “softness” is unknown. Simply put, further evidence is needed to prove whether ISQ at placement is any more informative than an experienced surgeon’s tactile assessment. Furthermore, the same authors concluded that ISQ levels were not diagnostic for implant mobility/failure when RFA was measured at time points after placement.

It is therefore not surprising that RFA/ISQ, like its fanfare-rich predecessor, the Periotest, has not been well received. ISQs, in general, appear to have neither a wide enough range nor the necessary precision to accurately discriminate between an implant that will survive and one that will fail. Although internal validity of the system has been well demonstrated, external validation as it applies to clinical practice remains unproven. Therefore, it is crucial that further research be conducted to determine whether the lack of validation in implant dentistry is due to flawed intellectual or technical application of the RFA concept or merely because of current insufficiently rigorous research. It may very well be that the true merit and clinical relevance of RFA remains undiscovered.

1. Meredith N, Alleyne P, Cawley D. Quantitative determination of the stability of the implant-tissue interface using resonance frequency analysis. *Clin Oral Implants Res* 1996;7:261–267.
2. Nedir R, Bischof M, Szmukler-Moncler S, Bernard JP, Samson J. Predicting osseointegration by means of implant primary stability. *Clin Oral Implants Res* 2004;15:520–528.

Copyright of International Journal of Prosthodontics is the property of Quintessence Publishing Company Inc. and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.