

“The RFA technique must be accurate and reliable”

Resonance Frequency Analysis (RFA) is today a standard method to measure implant stability, but the measurement unit ISQ itself needs to be explained. Prof. Lars Sennerby is one of the developers and researchers behind the RFA technique and will sort things out for us below.

Prof. Sennerby, what is your experience of the RFA technique?

Prof. Neil Meredith showed me a prototype of his invention already in 1992 and we have since then used RFA for implant stability measurements in numerous experimental and clinical studies: first as part of the early development work and Dr Meredith's Swedish PhD thesis (1997), which I supervised, and then as a clinical routine diagnostic instrument. I find it to give valuable and relevant information about implant stability at any time point during implant treatment and follow-up.

What is the background to the ISQ unit?

The whole purpose of introducing the ISQ (Implant Stability Quotient) was to give clinicians a unique and easy quantity on a scale from 1–100; the higher the value the better the stability. ISQ was introduced in 2001 and derives from a linear recalculation of the resonance frequencies (RF) in Hertz (Hz) obtained from measurements of dental implants with the first generation of wire-bound transducers.

How do you define the ISQ unit?

ISQ is calculated from the underlying RF of the transducer peg using a mathematical equation. The ISQ unit has not yet been defined using any other general or specific unit, simply because there is no such unit available. Instead, empirical data from more than 800 scientific publications has guided clinicians how to use the ISQ scale clinically.



Fig. 2



Fig. 1: The MulTiPeg device.

Fig. 2: Prof. Lars Sennerby.

How do we then know that implants with the same stability have the same ISQ?

It is of course desirable that different pegs for different implant designs give the same ISQ value if they have the same implant stability. This is a known problem when calibrating transducer pegs for different implant designs. It has not been so easy to solve, since implant stability per se has not been defined using any other quantity, and a reference had to be created. The reference can then be used when transducers are designed and developed. To explain the problem, think of two different implant designs that are placed in identical material and two different ISQ values are obtained. It is impossible to know if the difference depends on the fact that the two pegs are different or if it is because the stability is actually different, or a combination of the two. So a reference is indeed necessary.

So how did you solve this problem?

Studies have shown that bone density at the implant site determines the ISQ value and that it correlates with the implant's micro-mobility. This reflects the clamping ability of the bone, which in turn defines the micro-mobility. The problem is that different implant designs behave differently also in the same bone density, depending on surgical technique, design and self-tapping properties. So when calibrating pegs for different implant types, we embedded the different implant types in a dense material in an identical way. In addition, we gave all implants an identical outer geometry by molding each implant type into identical cylinders. The stability of each implant/cylinder can then be varied with a clamping device in a standardised manner. This also gave us the possibility to calibrate the pegs over the full ISQ scale and not only for a single value.

How do you use this calibration method?

With the method described above, a reference ISQ/stability relationship has been established, which is used when manufacturing MultiPegs for different implant designs. Each type of MultiPeg is designed to follow the standard ISQ/stability curve to assure that different types of implants show the same ISQ value

for the same stability. It is also an excellent method to assure that the peg has an optimal fit to the implant.

Why is the above important?

RFA is a great clinical tool, however, it is absolutely necessary that the technique is accurate, reliable and is based on a standard reference so that the stability of different implant types can be compared. This is particularly important if the academic and scientific community is going to agree on different clinical protocols based on ISQ values, for instance, when it is safe to apply immediate/early loading protocols.

Thank you for the interview.

contact**Integration Diagnostics Sweden AB**

Nedergårdsgatan 5
416 54 Göteborg, Sweden
Tel.: +46 733 842860
info@penguinRFA.com
www.penguinrfa.com

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