

## List of selected publications

### **Resonance Frequency Analysis (RFA) technique**

1. *Implant stability measurements using resonance frequency analysis: biological and biomechanical aspects and clinical implications.* Sennerby L, Meredith N. *Periodontology* 2000, Vol. 47, 2008, 51–66
2. *Immediate vs. early loading of SLA implants in the posterior mandible: 5-year results of randomized controlled clinical trial.* Kokovic V, Jung R, Feloutzis A, Todovoric V, Jurisic M, Hämmerle C. *Clinical Oral Implants Research*, 00, 2013, 1-6
3. *Early Loading of Nonsubmerged Titanium Implants with a Chemically Modified Sand-Blasted and Acid-Etched Surface: 6-Month Results of a Prospective Case Series Study in the Posterior Mandible Focusing on Peri-Implant Crestal Bone Changes and Implant Stability Quotient (ISQ) Values.* M Bornstein, C Hart, S Halbritter, D Morton, D Buser, Prof. Dr. med. dent. *Clin Implant Dent Relat Res* 2009
4. *The Predictive Value of Resonance Frequency Analysis Measurements in the Surgical Placement and Loading of Endosseous Implants.* Serge Baltayan, Joan Pi-Anfruns, Tara Aghaloo, Peter Moy. *J Oral Maxillofac Surg* 74:1145-1152, 2016
5. *Direct Implant Loading in the Edentulous Maxilla Using a Bone Density–Adapted Surgical Protocol and Primary Implant Stability Criteria for Inclusion.* Pär-Olov Östman, DDS; Mats Hellman, DDS; Lars Sennerby, DDS, PhD. *Clin Implant Dent Relat Res*. 2005;7 Suppl 1:S60-9
6. *Diagnosis of Implant Stability and its Impact on Implant Survival: A Prospective Case Series Study.* Daniel Rodrigo, Luis Aracil, Conchita Martin, Mariano Sanz. *Clin. Oral Impl. Res.* 21, 2010; 255-261
7. *The relationship between resonance frequency analysis (RFA) and lateral displacement of dental implants: An in vitro study.* Pagliani L, Sennerby L, Petersson A, Verrocchi D, Volpe S & Andersson P. *Journal of Oral Rehabilitation* 2012
8. *Implant Stability Quotient (ISQ) vs Direct in Vitro Measurement of Primary Stability (Micromotion): Effect of Bone Density and Insertion Torque.* P Trisi Phd, T Carlesi DDS, M Colagiovanni DDS, G Perfetti MD, DDS. *Journal of Osteology and Biomaterials*, Volume 1, Number3, 2010
9. *Early loading of titanium dental implants with an intra-operatively conditioned hydrophilic implant surface after 21 days of healing.* S Hicklin, E Schneebeil, V Chappuis, S Francesco, M Janner, D Buser, U Brägger. *Clin. Oral Impl. Res.* 00, 2015; 1-9
10. *Immediate vs non-immediate loading post-extractive implants: a comparative study of implant stability quotient (ISQ).* L. Milillo, C. Fiandaca, F. Giannoulis, L. Ottria, A.

11. *Influence of cortical bone and implant design in the primary stability of dental implants measured by two different devices of resonance frequency analysis: An in vitro study.* Chávarri-Prado D1, Brizuela-Velasco A2, Diéguez-Pereira M1, Pérez-Pevida E2, Jiménez-Garrudo A2, Viteri-Agustín I3, Estrada-Martínez A1, Montalbán-Vadillo O2. J Clin Exp Dent. 2020 Mar 1;12(3):e242-e248. “*The presence of cortical bone positively influences the primary stability of dental implants. The design of the implant also has a statistically significant influence on implant primary stability, although the impact depends on whether there is coronal cerclage or not. There were no statistically significant differences in the implant stability measurements obtained by two different devices*”.

### **Penguin RFA reduces treatment time**

1. *The functional loading of implants increases their stability: A retrospective clinical study.* Brizuela-Velasco A, Chávarri-Prado D. Clin Implant Dent Relat Res. 2019 Feb;21(1):122-129. “*Increases in ISQ values are greater during the months immediately following loading, which shows that immediate or early loading protocols are not only possible but can also be beneficial.*”
2. *Immediate vs non-immediate loading post-extractive implants: a comparative study of implant stability quotient (ISQ).* Milillo L, Fiandaca F et.al. Oral & Implantology. 2016 Mar: 123-131 ” *Provisional and immediate prosthetic techniques in post-extractive sites with cone-shaped implants, platform-switching abutment and bioactive surface may enhance ISQ values after four weeks, thus facilitating osseointegration and reducing healing time, as well as making this methodology predictable.*”

### **Penguin RFA removes doubt**

1. *The functional loading of implants increases their stability: A retrospective clinical study.* Brizuela-Velasco A, Chávarri-Prado D. Clin Implant Dent Relat Res. 2019 Feb;21(1):122-129. “*The functionalization of dental implants through the placement of implant-supported fixed prostheses increases their stability, measured in ISQ values by means of RFA.*”
2. *Can resonance frequency analysis detect narrow marginal bone defects around dental implants? An ex vivo animal pilot study.* Yao CJ, Mattheos N. Australian Dent Journal. 2017; 0: 1-7. “*ISQ values can effectively detect narrow, intrabony marginal bone defects, in particular when involving the first coronal 2 mm. This finding could have implications for the early diagnosis of conditions affecting the marginal bone, such as peri-implantitis.*”
3. *Resonance frequency analysis: Comparing two clinical instruments.* Becker W, Hujoel P, Becker BE. Clin Implant Dent Relat Res. 2018;20:308–312. “*Resonance frequency evaluation data were similar for both instruments, indicating their reliability in determining implant stability. Neither instrument predicted implant failure. While subjective, Penguin was less cumbersome to utilize and the window revealing the readings was very easier to read. Further, the pegs are magnetized making insertion easy.*”
4. *Immediate vs. early loading of SLA implants in the posterior mandible: 5-year results of randomized controlled clinical trial.* Kokovic V, Jung R, Feloutzis A, Todorovic VS, Jurisic M, Hämmerle CHF. Clin. Oral Impl. Res. 25, 2014, e114–e119. “*Consequently, biological implant stability was successfully obtained in all situations and no implants were lost... The*

*development of noninvasive diagnostic instruments for measuring of implant stability (RFA) has important role to detect early changes in this clinical parameter during the tissue integration.”*

5. *Diagnosis of implant stability and its impact on implant survival: a prospective case series study.* Rodrigo D, Aracil L, Martin C, Sanz M. Clin. Oral Impl. Res. 21, 2010; 255–261. *“Only secondary stability RFA values were able to significantly predict implant outcomes, but not primary stability values. There was a good correlation between RFA and the proposed clinical classification of primary stability”*
6. *Implant stability measurements using resonance frequency analysis: biological and biomechanical aspects and clinical implications.* Sennerby L, Meredith N. Periodontology 2000, Vol. 47, 2008, 51–66. *“The authors of the present study find the resonance frequency analysis technique to be helpful in deciding when to replace an immediately loaded temporary prosthesis with a permanent prosthesis after implant placement.”*
7. *The predictive value of resonance frequency analysis measurements in the surgical placement and loading of endosseous implants.* Baltayan S et.al. J Oral Maxillofac Surg 74:1145-1152, 2016. *“RFA is a noninvasive method to measure the stability of implants and help guide placement staging and loading protocols. This study showed that increasing ISQ values correlated with increased sensitivity in detecting implant failure.”*
8. M Bornstein, C Hart, S Halbritter, D Morton, D Buser, Prof. Dr. med. dent. Clin Implant Dent Relat Res 2009

### **Penguin RFA is reliable & repeatable**

1. *Resonance frequency analysis: Comparing two clinical instruments.* Becker W, Hujoel P, Becker BE. Clin Implant Dent Relat Res. 2018;20:308–312. *“Resonance frequency evaluation data were similar for both instruments, indicating their reliability in determining implant stability. Neither instrument predicted implant failure. While subjective, Penguin was less cumbersome to utilize and the window revealing the readings was very easier to read. Further, the pegs are magnetized making insertion easy.”*
2. *Diagnosis of implant stability and its impact on implant survival: a prospective case series study.* Rodrigo D, Aracil L, Martin C, Sanz M. Clin. Oral Impl. Res. 21, 2010; 255–261. *“Only secondary stability RFA values were able to significantly predict implant outcomes, but not primary stability values. There was a good correlation between RFA and the proposed clinical classification of primary stability”*
3. *Implant stability measurements using resonance frequency analysis: biological and biomechanical aspects and clinical implications.* Sennerby L, Meredith N. Periodontology 2000, Vol. 47, 2008, 51–66. *“The authors of the present study find the resonance frequency analysis technique to be helpful in deciding when to replace an immediately loaded temporary prosthesis with a permanent prosthesis after implant placement.”*
4. *Resonance frequency analysis: Agreement and correlation of implant stability quotients between three commercially available instruments.* Norton MR. Int J Oral Maxillofac Implants. 2018 Oct 3.
5. *Initial stability measurements of implants using a new magnetic resonance frequency*

*analyzer with titanium transducers: an ex vivo study.* Bural C, Dayan C, Geckili O. J Oral Implantol. 2020 Jan 6. “Recently developed Penguin RFA, is reliable and can be used in the clinical practice for the measurement of dental implant stability in regardless of the bone type.”

- In vitro comparative analysis of two resonance frequency measurement devices: Osstell implant stability coefficient and Penguin resonance frequency analysis.* Herrero-Climent M, Falcão A, López-Jarana P, Díaz-Castro CM, Ríos-Carrasco B, Ríos-Santos JV. Clin Implant Dent Relat Res. 2019 Dec;21(6):1124-1131. “Both ISQ devices allow for reliable and repeatable measurement of implant stability; however, the use of each device-specific transducer is recommended.”
- In vitro comparison of resonance frequency analysis devices to evaluate implant stability of narrow diameter implants at varying drilling speeds in dense artificial bone blocks.* Romanos GE, Bastardi DJ, Kakar A, Moore R, Delgado-Ruiz RA, Javed F. Clin Implant Dent Relat Res. 2019 Oct;21(5):1023-1027. “The OSSTELL and Penguin devices are reliable for the assessment of implant stability in dense artificial bone. Implant design and site-DS does not seem to have a significant impact of implant stability in artificial dense bone blocks”
- Can resonance frequency analysis detect narrow marginal bone defects around dental implants? An ex vivo animal pilot study.* Yao CJ, Mattheos N. Australian Dent Journal. 2017; 0: 1-7. “Penguin appeared to give a somewhat better consistency of readings, as there were fewer “outlying” results (i.e. single results in each set of three that appear to be more than 15 units different than the other two).”

### **Penguin RFA is non-invasive**

- The predictive value of resonance frequency analysis measurements in the surgical placement and loading of endosseous implants.* Baltayan S et.al. J Oral Maxillofac Surg 74:1145-1152, 2016. “RFA is a noninvasive method to measure the stability of implants and help guide placement staging and loading protocols. This study showed that increasing ISQ values correlated with increased sensitivity in detecting implant failure.”

### **Penguin RFA is easy to use and affordable**

- Resonance frequency analysis: Comparing two clinical instruments.* Becker W, Hujoel P, Becker BE. Clin Implant Dent Relat Res. 2018;20:308–312. “Resonance frequency evaluation data were similar for both instruments, indicating their reliability in determining implant stability. Neither instrument predicted implant failure. While subjective, Penguin was less cumbersome to utilize and the window revealing the readings was very easier to read. Further, the pegs are magnetized making insertion easy.”
- Resonance frequency analysis with two different devices after conventional implant placement with ridge preservation: A prospective pilot cohort study.* Brouwers JEIG, Buis S, de Groot PG, de Laat B, Remijn JA. Clin Implant Dent Relat Res. 2021 Oct;23(5):789-799. “Within the limitations of this cohort study, both devices were suitable for RFA-measurement and revealed comparable results. Due to the cable connection of the Osstell, handling with the cordless Penguin was stated as much easier, based on the experience, we have made during the experimental part of our present investigation. Finally there is an obvious difference in price between both measurement devices, with Penguin and reusable

*MultiPegs being advantageous from an economical point of view. Reusability of MultiPegs may offer an additional benefit with regard on ecological aspects.”*