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Clinical Monitoring with Resonance Frequency Analysis (RFA) of Astra Implants

A Clinical Study

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Introduction

A quantitative diagnostical technique capable of assessing implant stability, bone formation and the clinical performance of all implants is supposed to optimise the results and make them more predictable.

Objectives

This study is set up to investigate the healing process of Astra Tech Implants in order to standardise the healing period with available data.

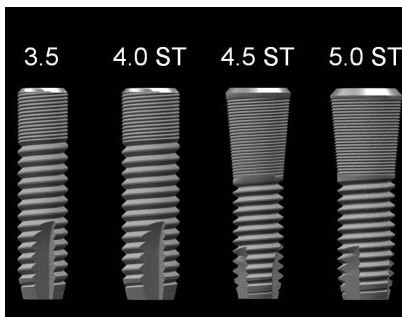
Material and Methods

20 patients thereof 11 females and 9 males with an average age of 50,5 years were provided with 47 self-tapping Astra Tech Implants. We placed 24 Astra Tech ST Implants with diameter of 4,5 to 5,0 mm and 23 Astra Tech Universal Implants with diameter of 3,5 to 4,0 mm, all 9 to 15 mm in length according to the two-stage surgical protocol of Astra Tech Dental Implant System. 24 fixtures were placed in the mandible and 23 maxilla (Table 1).

	9,0 mm	11,0 mm	13,0 mm	15,0 mm	
Ø 3,5 mm	2	5	11	2	20
Ø 4,0 mm			4		4
Ø 4,5 mm		5	14	1	20
Ø 5,0 mm	1	1			3
					47

Tab. 1

After implant placement the primary stability was determined by the Resonance frequency analysis (RFA) according to Meredith et al (1996). Insertion followed under local anesthesia with Ultracain DS and the manufacturer's instructions, with a healing period of 90 days for the mandible as well as the maxilla. After reentry the secondary stability was determined by resonance frequency analysis. All fixtures were immediately provided with a fixed prosthetic supply. The Resonance frequency analysis makes use of a small L-shaped autoclavable transducer attached by a screw to the Astra Tech Implants perpendicular to the alveolar ridge. Oscillations are produced from the piezo-elements inside the transducer which is connected by wire through the transducer plug-memory to the Osstell-instrument (Integration Diagnostics Ltd, Sävedalen, Sweden). The beam of the transducer is excited over a range of frequencies (from 5 to 15 kHz) and the resonance frequency of the beam is measured and automatically translated into an index called: Implant Stability Quotient. The ISQ runs from 1 to 100. The relationship between the ISQ-value and the resonance frequency value is close to linear.



Astra Tech Implants

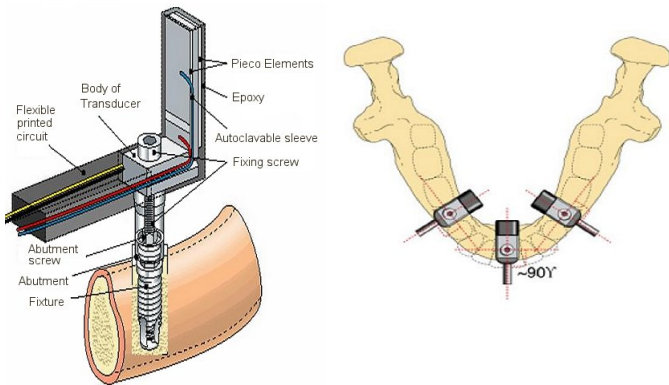


The Osstell-Instrument

Results

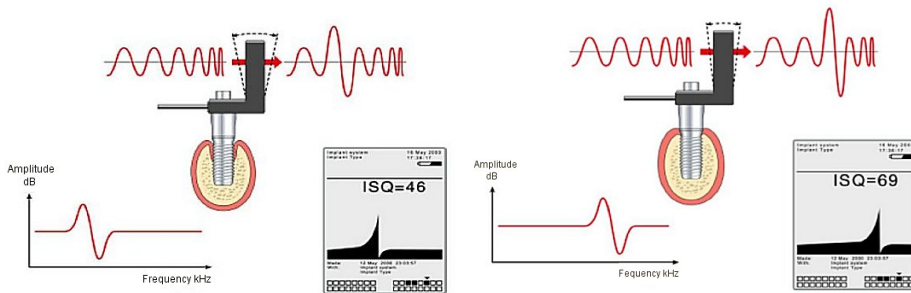
All implants showed a high initial primary stability (\emptyset ISQ 67,35). The fixtures placed in the mandible reached a higher primary stability (\emptyset ISQ 69,46) than fixtures in the maxilla (\emptyset ISQ 65,25). After 90 days the Astra Tech Implants showed an increase in stability of 2,64 units (\emptyset ISQ 69,99). Hereby the 24 mandibular fixtures showed a significantly higher increase in stability by 3,60 units (\emptyset ISQ-value 73,06) than the 23 implants in the maxilla with 1,83 units (\emptyset ISQ-value 67,08). During the healing period of 90 days as well as in function no implant failed up to now.

Resonance frequency analysis (RFA)



L-shaped transducer

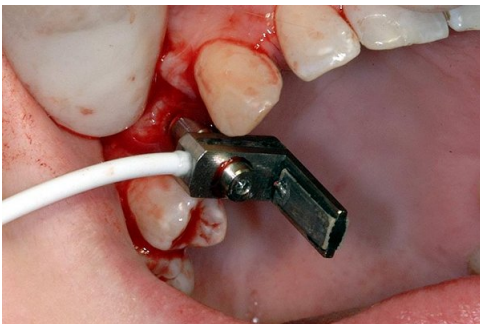
Transducer perpendicular to the alveolar ridge



The beam of the transducer is excited over a range of frequencies...

...the resonance frequency of the beam is measured and translated into an ISQ-value.

Clinical examples



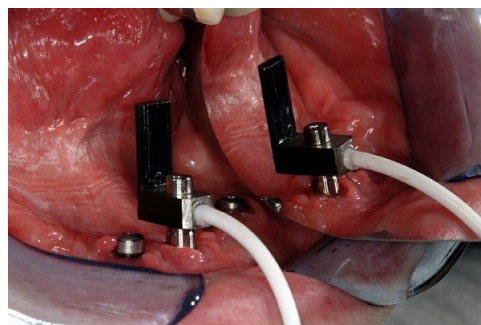
RFA after implant placement



Seven days after reentry



Conical abutment connection



RFA after reentry

Discussion and Conclusions

The functional loading of Astra Tech Implants in bone sites without any additional augmentations after 90 days is a predictable and successful treatment of the mandible as well as of the maxilla. It is a safe surgical procedure for Astra Tech ST-Implants as well as for Astra Tech Uni-Implants. In a subsequent study we are realizing at the moment a reduced healing period of 56 days with Astra Tech Implants with ISQ-values of more than 65,00. In the case of increased stability after 56 days of healing the implant will be provided immediately with the prosthetic supply. With ISQ-values of less than 65,00 the healing abutment will be left in its place for further 56 days in the sense of a progressive loading.

Abbreviations


RFA = Resonance Frequency Analysis
ISQ = Implant Stability Quotient

This Poster was submitted by Argiris Samiotis.

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Poster Faksimile:



11th EAO Annual Scientific Congress
September 12-14th, 2002 in Congress Palace, Coudenberg 3,
Brussels, Belgium

**CLINICAL MONITORING WITH RESONANCE FREQUENCY ANALYSIS (RFA)
OF
ASTRA IMPLANTS**

Samiotis A., Steveling H.G., Hassfeld S.
Department of Oral and Maxillofacial Surgery, University of Heidelberg,
Chairman Prof. Dr. Dr. J. Mühling

Introduction

A quantitative diagnostical technique capable of assessing implant stability, bone formation and the clinical performance of all implants is supposed to optimise the results and make them more predictable. This study is set up to investigate the healing process of Astra Tech implants in order to standardise the healing period.



Material and Method

20 patients - 11 females and 9 males - aged 50,5 years on average, were provided with 47 self-tapping Astra Tech Implants. We placed 24 Astra Tech ST Implants sized 4,5 to 5,0 mm in diameter, and 23 Astra Tech Universal Implants sized 3,5 to 4,0 mm in diameter, all 9 to 15 mm in length, according to the two-stage surgical protocol of Astra Tech Dental Implant System. 24 fixtures were placed in the mandible and 23 in the maxilla (tab.1).

	5,0mm	4,5mm	3,5mm	11,0mm	13,0mm	15,0mm
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⊙ 4,5mm			4			4
⊙ 5,0mm	5	14	1	1		20
⊙ 5,5mm	1	1	1			25

After implant placement the primary stability was determined by the Resonance frequency analysis (RFA) according to Meredith et al (1996). Insertion followed under local anesthesia with Ultracain D5 and the manufacturer's instructions, with a healing period of 3 months for the mandible as well as the maxilla. After reentry the secondary stability was determined by resonance frequency analysis. All fixtures were immediately provided with a fixed prosthetic supply.



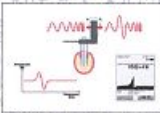
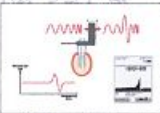
The Resonance frequency analysis makes use of a small L-shaped autoclavable transducer attached by a screw to the Astra Tech Implants perpendicular to the alveolar ridge. Oscillations are produced from the piezo-elements inside the transducer which is connected by wire through the transducer plug-memory to the Ostell-instrument (Integration Diagnostics Ltd, Sävedalen, Sweden). The beam of the transducer is excited over a range of frequencies (from 5 to 15 kHz) and the resonance frequency of the beam is measured and automatically translated into an index (called Implant Stability Quotient). The ISQ runs from 1 to 100. The relationship between the ISQ-value and the resonance frequency value is close to linear.





Results

All implants showed a high initial primary stability (⊙ ISQ 67,35). The fixtures placed in the mandible reached a higher primary stability (⊙ ISQ 69,46) than fixtures in the maxilla (⊙ ISQ 65,25). After 3 months the Astra Tech Implants showed an increase in stability of 2,64 units (⊙ ISQ 69,99). Hereby the 24 mandibular fixtures showed a significantly higher increase in stability by 3,60 units (⊙ ISQ 73,06) than the 23 implants in the maxilla with 1,83 units (⊙ ISQ 67,08). During the healing period of 3 months as well as the time in function no implant has failed up to now.

Resonance frequency analysis (RFA)

Clinical examples

Conclusion

The functional loading of Astra Tech Implants after 3 months is a predictable and successful treatment of the mandible as well as of the maxilla. It is a safe surgical procedure for Astra Tech ST-implants as well as for Astra Tech Uni-Implants. In a subsequent study we are realizing at the moment a reduced healing period of 8 weeks with Astra Tech Implants with ISQ-values of more than 67,00. In the case of increased stability after 8 weeks of healing the implant will be provided immediately with the prosthetic supply. With ISQ-values of less than 67,00 the healing abutment will be left in its place for further 8 weeks in the sense of a progressive loading.

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