TOPICS – Day 1

- Factors influencing the long-term stability of dental implants
- Surgical procedures in posterior sites: Standard implant placement with or without flap elevation
- Surgical procedures in posterior sites: implant placement with GBR
- **Implant placement and sinus floor elevation: Lateral window vs. Osteotome technique, when simultaneous, when staged?**
- Prosthetic planning and restorative principles in posterior sites
- Fundamental esthetic principles revisited in the context of anterior maxillary implant restorations – a critical appraisal
- Esthetic risk assessment and basic surgical principles in esthetic sites
- Prosthetic handling of esthetic challenges: case reports

Implant Placement in the Posterior Maxilla

- These implant locations have gained significant importance, since teeth are often lost in these sites in the baby boomer generation
  - Endodontic lesions and/or periodontal breakdown
- The bone height is often reduced in PM2 and M1
- Often, patients can only choose between an implant supported FDP or a tooth stabilized RDP

Implant Locations

Posterior Maxilla: 849 impl= 37.5%

2014-2016	9	137	133	122	67	87	157	122	104	75	145	120	170	13	1461	64.6%
max	17	16	15	14	13	12	11	21	22	23	24	25	26	27		
mand	47	46	45	44	43	42	41	31	32	33	34	35	36	37		
2014-2016	18	175	83	48	73	11	14	10	17	63	46	75	158	9	800	35.4%

Total = 2'261

Bornstein et al. 2008; Engel-Brugger et al. 2015; Ducommun et al. (in manuscript)

ITI – Forum Implantologicum 13: 6-19, 2017

Treatment Options for the Posterior Edentulous Jaw: Surgical Options for Implant Therapy in the Posterior Maxilla of Partially Edentulous Patients

Daniel Buser, Alberto Monje, Waldemar Polido

TOPICS

- Anatomy and risk factors
- Option 1: Short implants
- Option 2: Implant placement with simultaneous SFE
- Option 3: SFE first, followed by implant placement
- Healing periods in the posterior maxilla
- Conclusions

TOPICS

- Anatomy and risk factors
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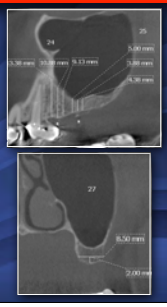
Nunes, Bornstein, Sendi, Buser: Anatomical characteristics and dimensions of edentulous sites in the posterior maxilla of patients referred for implant therapy. A radiographic analysis using limited cone-beam computed tomography (CBCT). *Int J Periodont Res Dent* 33:337-45, 2013

- The purpose of the present study was to analyze the width and the height of the edentulous posterior maxilla
- Examination of 122 CBCT's, which included 252 edentulous sites in the posterior maxilla
- The oro-facial crest width was measured perpendicular to the alveolar ridge (2 mm below the most coronal point of the crest)
- The bone height was analyzed in the respective sagittal slices (3 measurements per tooth position)



Nunes, Bornstein, Sendi, Buser: Anatomical characteristics and dimensions of edentulous sites in the posterior maxilla of patients referred for implant therapy. A radiographic analysis using limited cone-beam computed tomography (CBCT). *Int J Periodont Res Dent* 33:337-45, 2013

Crest Width

Frequency distribution (%) of examined teeth according to the mean crest width

	< 4mm	4 - 5.99mm	6 - 9.99mm	≥ 10mm
1st PM	8.9%	26.7%	62.2%	2.2%
2nd PM	4.5%	16.7%	69.7%	39.1%
1st M	0	5.9%	58.9%	35.2%
2nd M	1.8%	8.9%	48.2%	41.1%
TOTAL	3.2%	13.1%	59.9%	23.8%

Nunes, Bornstein, Sendi, Buser: Anatomical characteristics and dimensions of edentulous sites in the posterior maxilla of patients referred for implant therapy. A radiographic analysis using limited cone-beam computed tomography (CBCT). *Int J Periodont Res Dent* 33:337-45, 2013

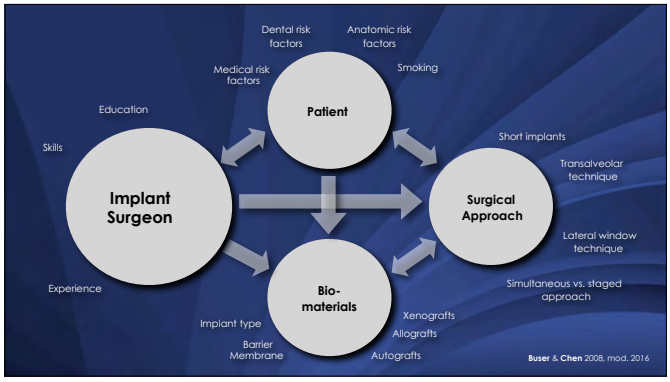
Ridge Height

Frequency distribution (%) of examined teeth according to the mean bone height

	< 5mm	5 - 7.99mm	8 - 9.99mm	≥ 10mm
1st PM	0	4.4%	13.3%	82.3%
2nd PM	21.2%	36.7%	12.1%	30%
1st M	54.1%	34.1%	7.1%	4.7%
2nd M	44.6%	50%	3.6%	1.8%
TOTAL	33.7%	33%	8.7%	24.6%

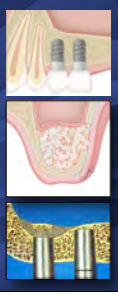
Presurgical Analysis in the posterior Maxilla with CBCT

- Which anatomic structures are of interest:
  - ✓ If present, anatomy of questionable teeth
    - ➡ Anatomy of roots
    - ➡ Periapical bone structure
    - ➡ Facial and palatal bone wall
    - ➡ Neighbourhood to maxillary sinus
  - ✓ Ridge width and bone height at potential implant sites
  - ✓ Anatomy of the maxillary sinus
    - ➡ Extension of maxillary sinus
    - ➡ Status of Schneiderian membrane
    - ➡ Presence or absence of bony septi: Size, position and direction
    - ➡ Foreign bodies in the maxillary sinus



Implants in the posterior Maxilla

Surgical Techniques



- Standard implant placement with short implants
  - 6 mm implants, but splinted to other implants
- SFE with lateral window technique
  - Boyne & James, 1980
  - Tatum, 1986
- SFE with transalveolar Osteotome technique
  - Summers, 1994

Various Surgical Procedures

Surgical Procedure	2002-04	%	2008-10	%	2014-16	%
Implants Standard, open flap	878	48.3	877	38.2	856	37.9
Implants Standard, flapless	0	0.0	34	1.5	29	1.3
Implants with GBR	722	39.7	962	42.2	972	43.0
simultaneous GBR	599	33.0	889	39.0	887	39.0
staged GBR	123	6.7	73	3.2	85	3.2
Implants with SFE	217	11.9	402	17.8	403	17.8
simultaneous osteotome tx	35	1.9	63	2.8	35	2.8
simultaneous window tx	122	6.7	195	8.6	233	8.6
staged window tx	60	3.3	145	6.4	135	6.4
Implants with GBR & SFE	939	51.7	1364	60.0	1375	60.8
Total	1' 817	100.0	2' 279	100.0	2261	100.0

Bornstein et al. 2008; Engel-Brugger et al. 2015; Ducommun et al. (in manuscript)

The most important Question

- How many implants are placed?
- Option 1: Only one implant is inserted
  - Reduced flexibility for short or ultra-short implants
- Option 2: At least two adjacent implants are placed
  - Splinting of implant crowns increases the flexibility

TOPICS

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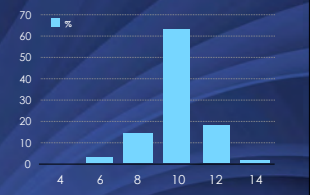
Principles of Implant Surgery

Selection of Implant Length

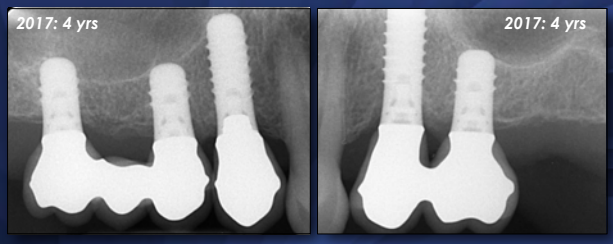
- **Implant length utilized in 2014-16**

• 4 mm	13	(0.6%)
• 6 mm	49	(2.3%)
• 8 mm	304	(14.0%)
• 10 mm	1'378	(63.6%)
• 12 mm	386	(17.8%)
• 14 mm	38	(1.8%)

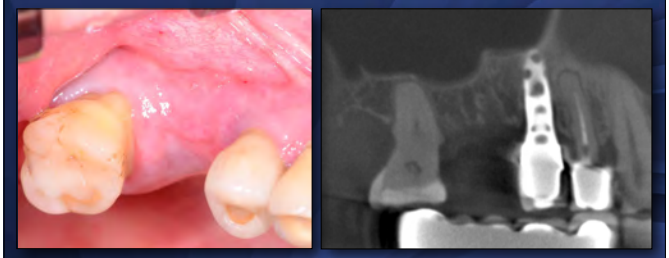
Total = 2'168



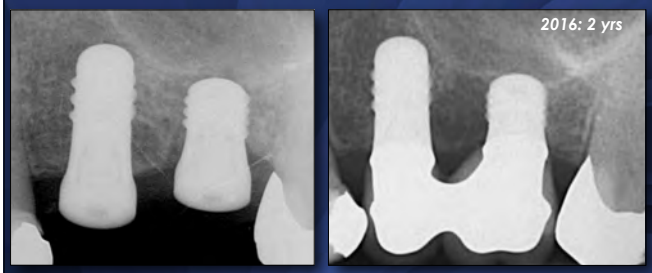
6 mm Implants can sometimes be used to avoid SFE procedures, but then they are most often splinted



Exceptions are only made in very old patients (age >80 yrs) to offer a least demanding surgery for the patient



We started to use ultra-short 4 mm Implants in well selected cases



Selection of Short Implants

- Important rule: Don't give up implant length, if it is not needed
- Need for shorter implants must be dictated by anatomy
  - ✓ Mandibular canal
  - ✓ Floor of the sinus
- When 6 mm or even 4 mm implants are used, they are always splinted to other implants
  - ✓ New 5-year study by Rossi et al. COIR 2016
    - * Non-splinted implants in 1st molar sites in the mandible
    - * 10 mm implants (SLA): 96.7 % survival
    - * 6 mm implants (SLA): 86.7 % survival (= 13.3% failure rate at 5 years!)
  - ✓ New 4-year study by Villarinho et al. CIDRR 2017
    - * 6 mm non-splinted implants in posterior sites of the maxilla and the mandible
    - * 91.3% survival rate
    - * 28.3% technical complications
    - * 65.2% success rate

Survival Rates of non-splinted short 6 mm Implants

Authors (year)	Patients (n)	Implants (n)	Follow-up (months)	Implant length (mm)	Survival rate (%)	Technical complications (%)
Rossi et al, (2016)	30	30	60	6	86.7%	NR
Villarinho et al. (2017)	20	46	45	6	91.3%	28.3%

TOPICS

- Anatomy and risk factors
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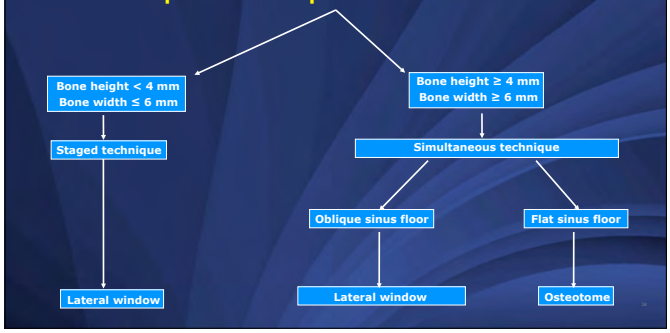
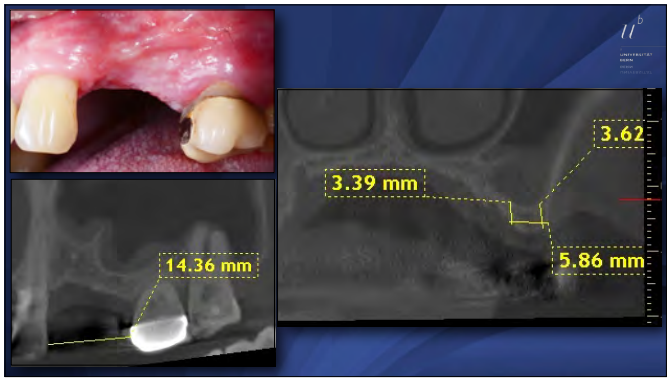
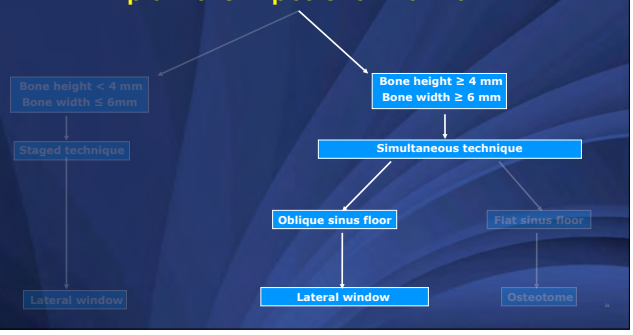
Implant Site in posterior Maxilla





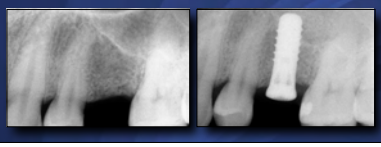
Implant Site in posterior Maxilla

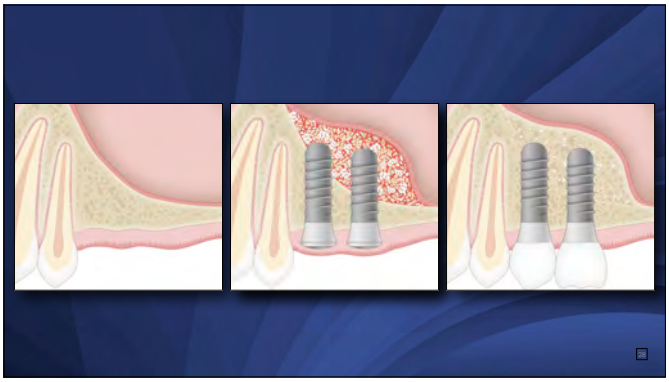


Sinus Floor Elevation Procedure

Window Technique simultaneous

- Bone height ≥ 4 mm
  - ✓ This provides sufficient primary implant stability
- Alveolar crest should be sufficient in width
- This is the most frequent technique of SFE





Bone Fillers for SFE

Important Requirements

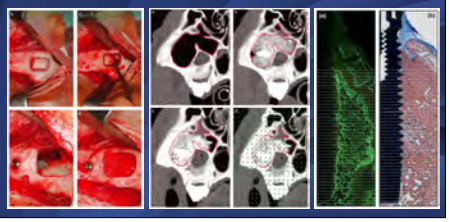
- Bone filler should accelerate new bone formation
  - ✓ High osteogenic potential
- Bone filler should maintain the created volume
  - ✓ Low substitution rate

➡ None of the current bone fillers fulfills both requirements
➡ A combination of two bone fillers is beneficial (= Composite Graft)

Jensen T, Schou S, Svendsen PA, Forman JL, Gundersen HJG, Terheyden H, Holmstrup P. Volumetric changes of the graft after maxillary sinus floor augmentation with Bio-Oss and autogenous bone in different ratios: a radiographic study in minipigs. *Clin Oral Implant Res* 23:902-10, 2012
Jensen T, Schou S, Gundersen HJG, Forman JL, Terheyden H, Holmstrup P. Bone to implant contact after maxillary sinus floor augmentation with Bio-Oss and autogenous bone in different ratios in mini pigs. *Clin Oral Implant Res* 24:635-44, 2013

Materials & Methods

- 30 minipigs
- Impl. plac. with SFE
- 5 different bone filler
  - A: auto 100
  - B: auto 75/DBBM 25
  - C: auto 50/ DBBM 50
  - D: auto 25/ DBBM 75
  - E: DBBM 100
- 12 weeks of healing



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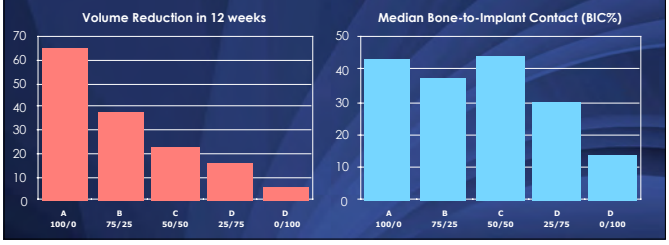
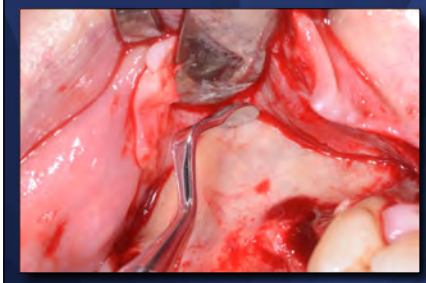


Since 2002: Local Graft Harvesting



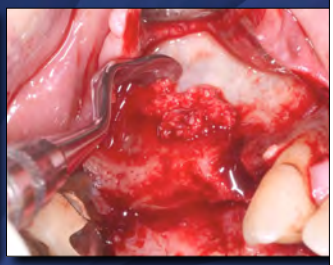
Surgical Techniques

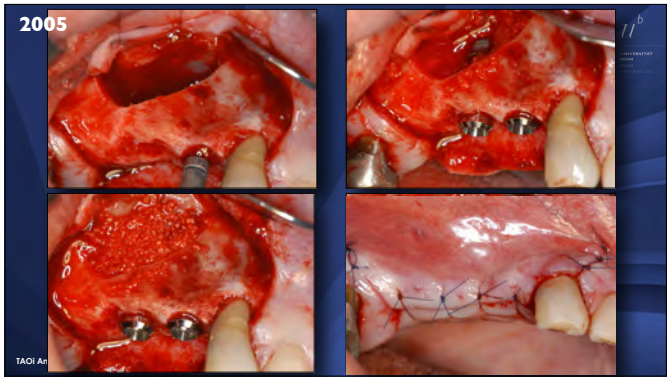
- Bone scraper
- Bone chisel

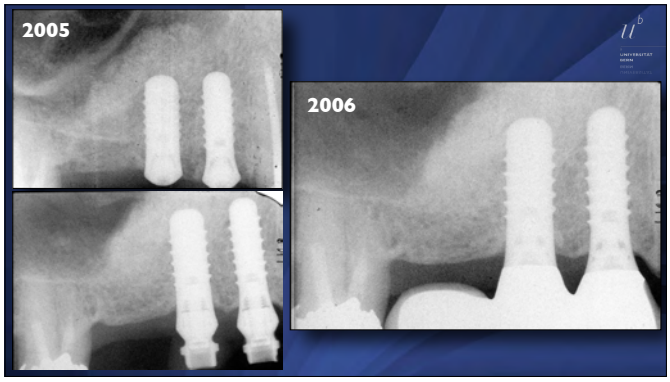
Advantages

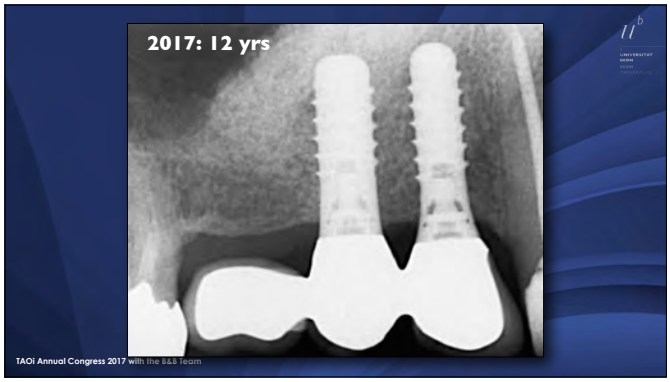
- No donor site with additional morbidity
- Reduced surgical time

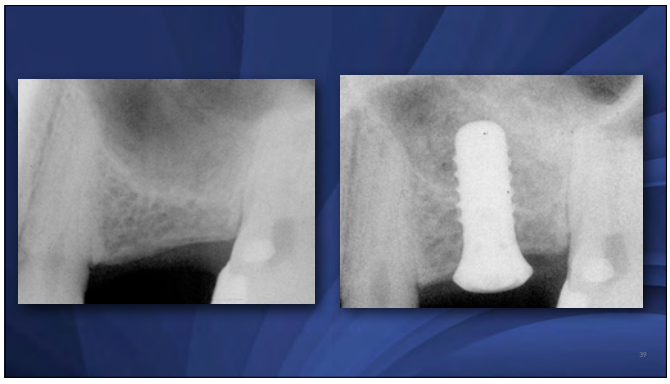
Local Harvesting of Bone Chips with a sharp Bone Scraper

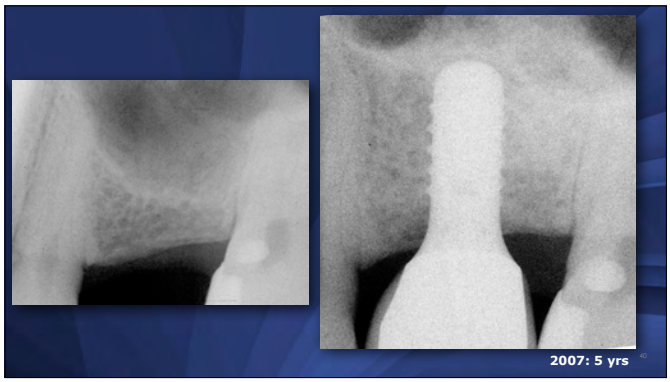


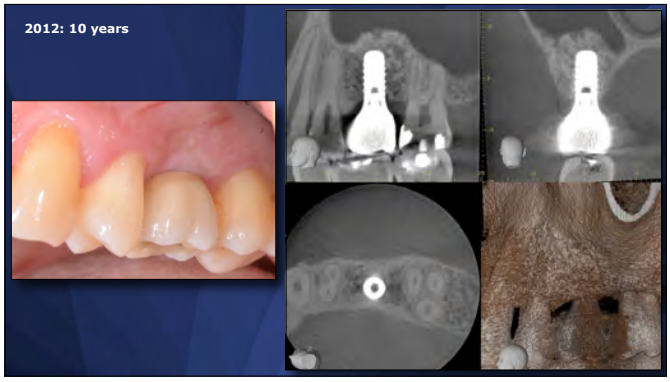

2005

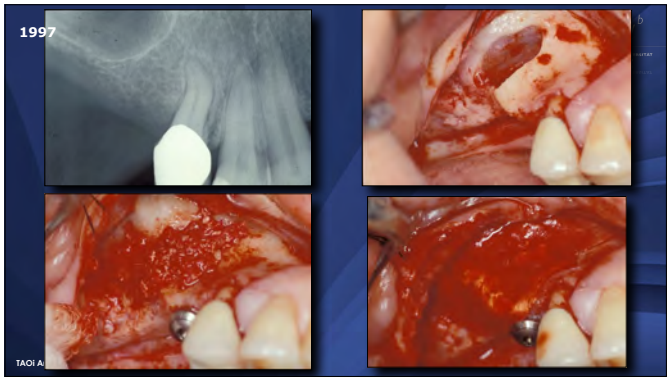

2005
2006


2017: 12 yrs
TAOi Annual Congress 2017 with the B&B Team




2007: 5 yrs


2012: 10 years


1997


2003: 6 yrs
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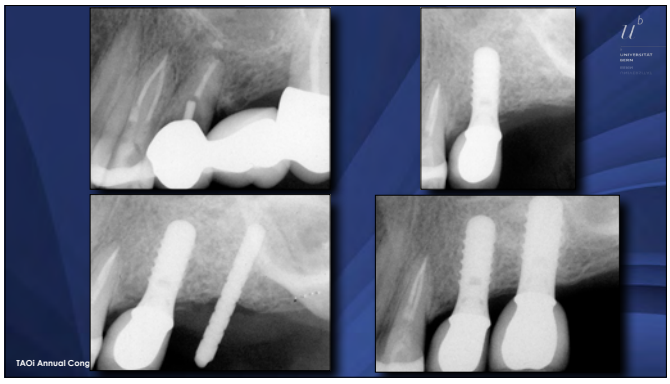
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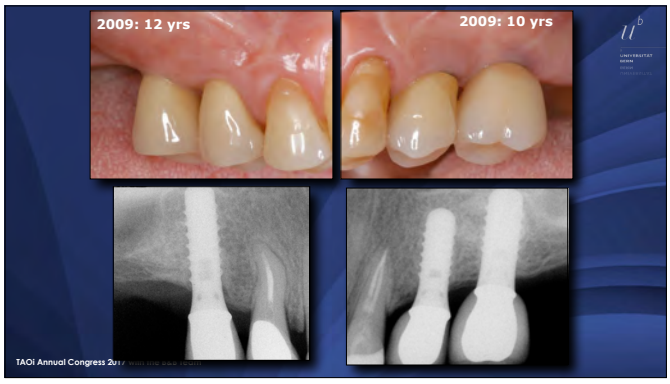

2009: 12 yrs
2009: 10 yrs

Implant Site in posterior Maxilla

Bone height < 5mm
Bone width ≤ 6mm

Staged technique

Lateral window

Bone height ≥ 4 mm
Bone width ≥ 6 mm

Simultaneous technique

Oblique sinus floor

Lateral window

Flat sinus floor

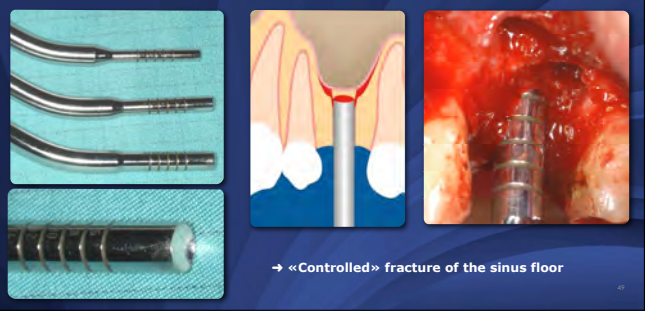
Osteotome

Sinus Floor Elevation Procedure

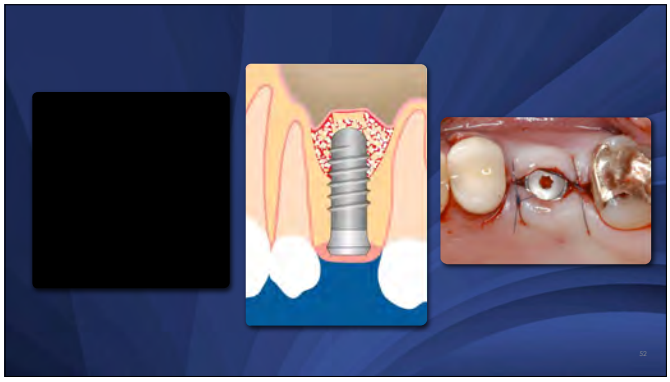
Transalveolar Osteotome Technique simultaneous

- You can only gain 3-5 mm
- Bone height 5-8 mm
- The sinus floor should be flat in mesio-distal and oro-facial direction
- The technique is not so easy and technique sensitive

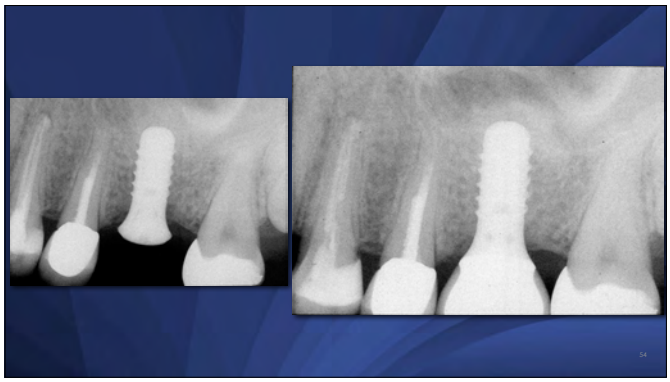
Osteotome Technique



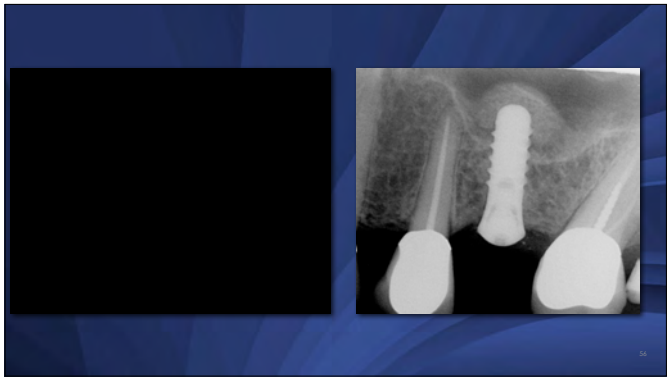
→ «Controlled» fracture of the sinus floor




8 weeks
75




2015: 10 yrs



TOPICS

- Anatomy and risk factors
- Option 1: Short implants
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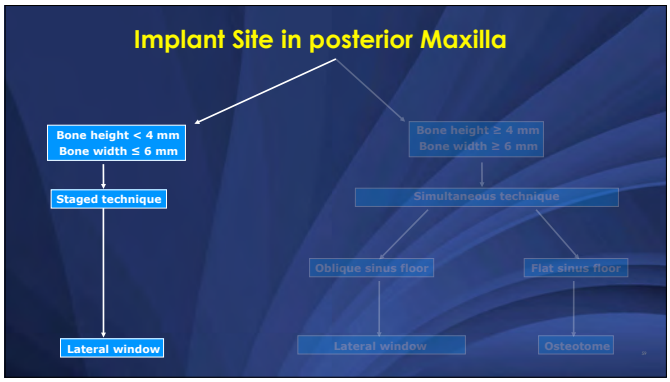
Implant Site in posterior Maxilla



Sinus Grafting Procedure

Window Technique staged

- Bone height < 4mm
- Can be combined with ridge augmentation procedures
- Window preparation with diamond drills and with Piezo technique
- Special sinus instruments are needed


Healing 5 months
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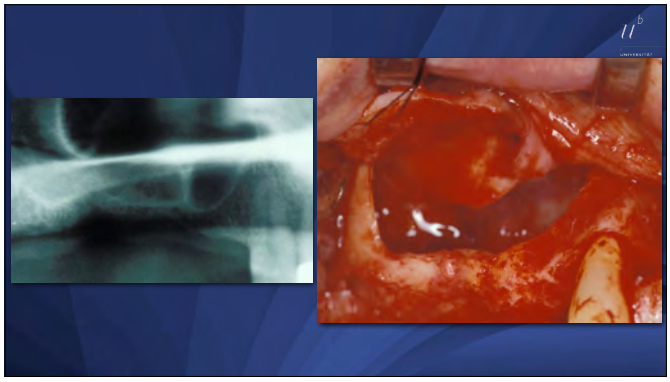
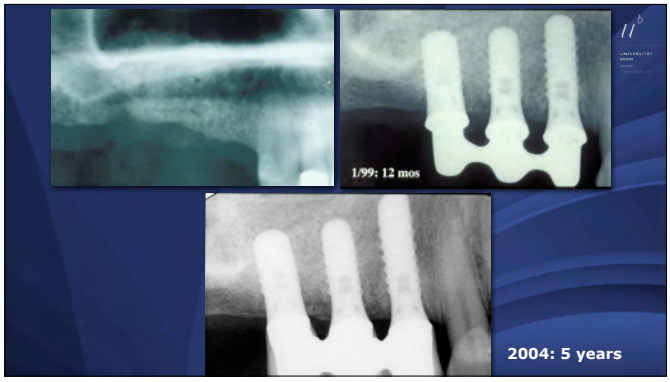
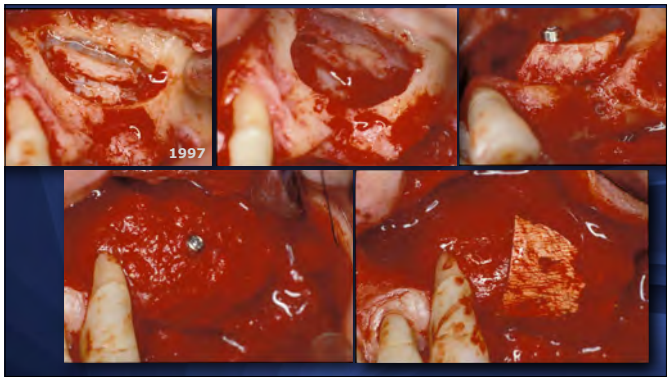
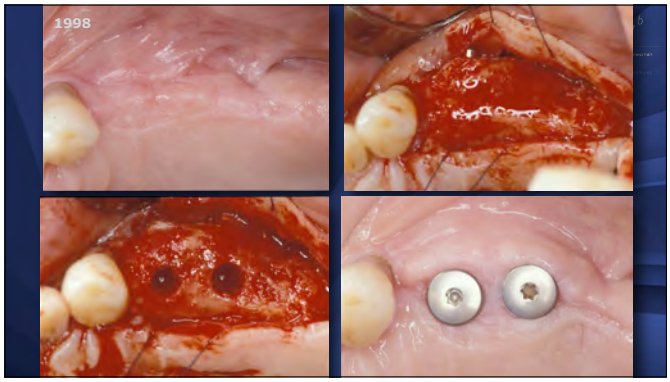


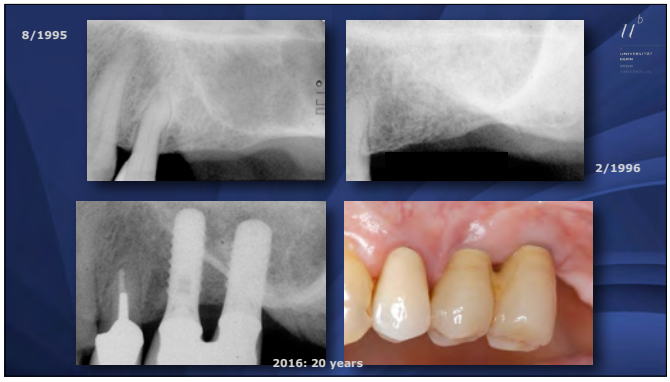

1/99: 12 mos
2004: 5 years


1997


1998


1999


2010: 12 years



TOPICS

- Anatomy and risk factors
- Option 1: Short implants
- Option 2: Implant placement with simultaneous SFE
- Option 3: SFE first, followed by implant placement
- Healing periods in the posterior maxilla
- Conclusions

Implants in the posterior Maxilla

Healing Periods

• Osteotome Tx:	2 months
• Window simultaneous:	2-4 months
• Window staged:	5 months
✓ HP for implants	2 months

- Routine use of SLActive implants
- Routine use of ISQ values (RFA technique)

Ostell Device (3rd Generation)

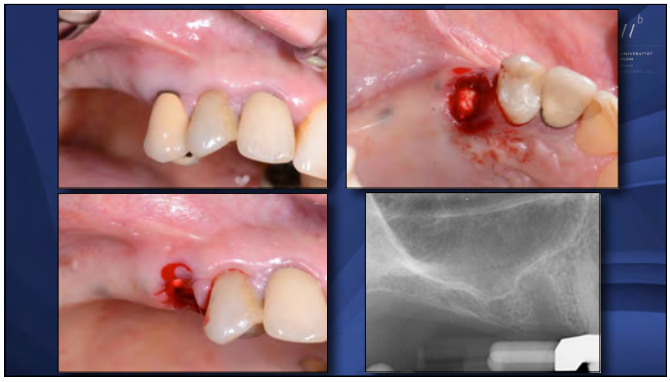
Some Studies on RFA

- Meredith, Alleyne, Cawley: Quantitative determination of the stability of the implant-tissue interface using resonance frequency analysis. *Clin Oral Implants Res* 7: 261-267, 1996
- Meredith, Shagaldi, Alleyne, Sennerby, Cawley: The application of resonance frequency measurements to study the stability of titanium implants during healing in the rabbit tibia. *Clin Oral Implants Res* 8:234-243, 1997
- Cornelini, Cangini, Covani, Barone, Buser: Immediate Loading of Implants with 3-unit Fixed Partial Dentures: A 12-month Clinical Study. *Int J Oral Maxillofac Implants* 21: 914-918, 2006.
- Valderrama, Oates, Jones, Simpson, Schoolfield, Cochran: Evaluation of two different resonance frequency devices to detect implant stability: a clinical trial. *J Periodontol* 78:262-272, 2007
- Bornstein, Hart, Halbritter, Morton, Buser: 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. *Clin Impl Dent Rel Res* 2009 (e-pub)

Implant Placement with SFE

Healings Periods and Loading Protocols

- The Ostell technique is used in all SFE patients
- A baseline ISQ measurement is taken during surgery
- At 8 weeks, a second ISQ value is measured
- Patients with ISQ ≥70 will be restored (>80%)
- Patients with ISQ <70 will get an additional 4 week healing period




44
55


2012.09.28: post op.

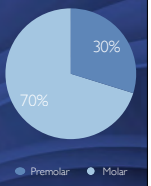

2012.11.21: 8 weeks
53
65


2012.12.07: 10 weeks
68
2012.12.20: 12 weeks
71

Kuchler U, Chappuis V, Bornstein MM, Siewczyk M, Gruber R, Maestre L, Buser D: Development of ISQ values of implants placed with simultaneous sinus floor elevation – Results of a prospective study with 109 implants. *Clin Oral Implants Res* 28:109-115, 2017

Prospective case series study

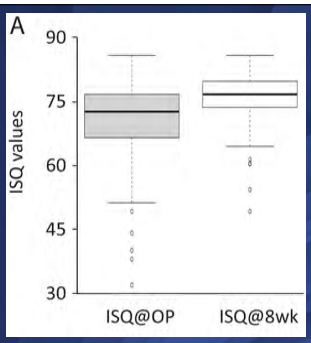
- A baseline ISQ measurement is taken during surgery
- 109 Implants in 97 patients were included
- 46 male and 51 female patients, average age 63 years
- Implant placement with simultaneous SFE (window technique)
- Utilization of Tissue Level Implants with SLActive surface
- Utilization of *Composite Grafts*
  - ✓ Locally harvested autologous bone chips plus DBBM
- *Measurement of ISQ values*
  - ✓ *at Baseline and after 8 weeks*



ISQ @ OP

Mean 67.5
SD +/- 10.0

Median 69.9
min 28.0
max 85.0

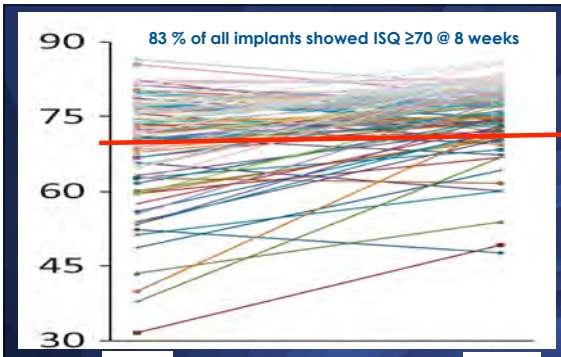


ISQ @ 8weeks

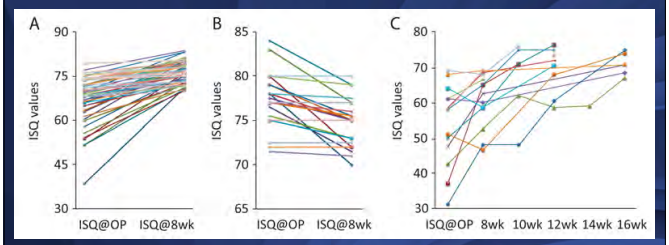
Mean 73.7
SD +/- 6.8

Median 74.5
min 45.0
max 85.0

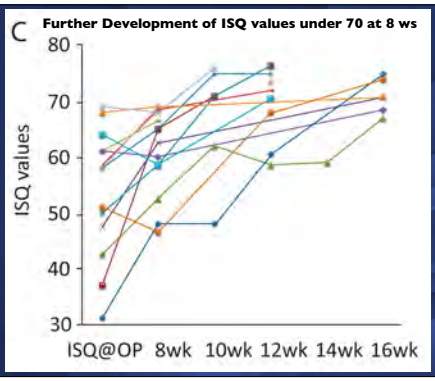
Significant increase of ISQ values within 8 weeks



Development of ISQ Values over time



16.4% not reaching ≥70 ISQ @8w



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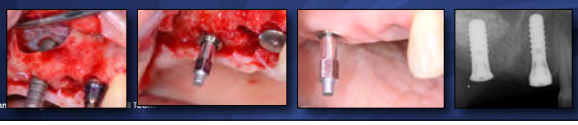
Conclusions

- 83 % implants placed with SFE showed ISQ ≥70 and were ready for prosthetic rehabilitation
- 1 early failure occurred during healing due to an infection (=0.8%)
- Monitoring of implant stability with ISQ is an effective diagnostic tool
- These favorable results are caused by autografts, the osteophylic implant surface and the good primary stability offered by tissue level implants



TAOI Ann

Loading Protocols in Implant Dentistry

TOPICS

- Anatomy and risk factors
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Implant Therapy in the Posterior Maxilla

- The posterior maxilla is a challenging area for implant therapy
- A reduced ridge height is the most significant problem
- The clinician has 3 different options for treatment
- The use of short 6 mm implants is mainly possible, when multiple adjacent implants can be utilized
- Then, a splinting of implant crowns is routine
- Single standing short 6 mm implants are only used in g[illegible] patients
- Ultra-short 4 mm are rarely used and always splinted w[illegible] exception
- There are not mid-term, 5-year data published yet on 4 mm implants

Implant Therapy in the Posterior Maxilla

- When short implants are not possible, a sinus floor elevation (SFE) procedure is used
- For implant placement with simultaneous SFE, we use both techniques with a clear preference for the window technique
- The osteotome tx is only used, when a flat sinus floor is present
- When the ridge height is ≤4 mm, a staged approach for SFE and implant placement is used
- The results are very satisfactory, but the 10 year data is not analyzed yet. They will be available by the end of 2017!
- We use rather short healing period, since we routinely use (a) a composite graft with autogenous bone chips and DBBM, and (b) a hydrophilic implant surface (SLActive)