TOPICS – Day 2

- Implant placement post extraction with simultaneous contour augmentation using GBR: When immediate, when early, when late?
- CAD-CAM technology and zirconia: new opportunities for esthetic single-tooth restorations
- Complex GBR pocedures
- Prosthetic handling of compromised sites and extended edentulous spaces in the anterior maxilla
- Surgical handling of esthetic implant failures
- Pink ceramic to compensate peri-implant soft tissue deficiencies

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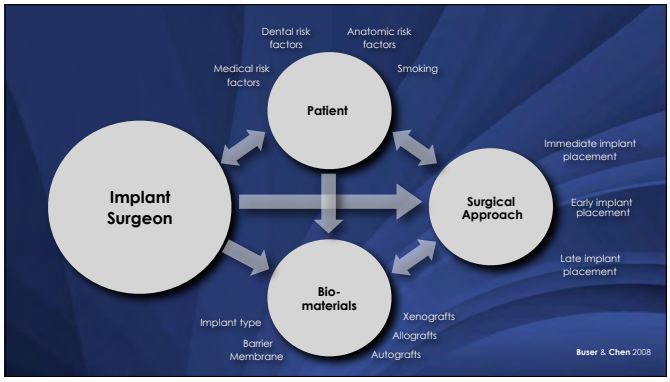
TOPICS

- Short introduction
- Treatment options: When immediate, when early, when late?
- Long-term results of early implant placement with contour augmentation
- Conclusions

Implant Placement post Extraction

- This is today the most frequent indication for implant therapy
  - It makes up more than 70% of implants placed
- Implant sites in the esthetic zone are demanding
  - Cat. A or Cat. C
- The timing of the treatment is crucial
  - when to place and when to restore the implant

- **Teeth need to be extracted for various reasons**
  - Teeth with endo and or perio lesions
  - Post-trauma teeth with root resorption or ankylosed in apical malposition
  - Baby teeth
- **The tooth extraction is the first step of the treatment planning**



Surgical Recipe for successful Outcomes in Implant Esthetics

- Good understanding of **tissue biology**
  - Concept of **biologic width**
    Berglundh & Lindhe 1996, Cochran et al. 1997 Kan et al. 2003
  - **Hard and soft tissue alterations** following extraction
    Schropp et al. 2003, Araujo et al. 2005a,b, Araujo et al. 2006a,b, Chappuis et al. 2013, Chappuis et al. 2015, Chen et al. 2016
  - **Biology of bone defects**
    Schenk et al. 1994, Buser et al. 2009
- Detailed **esthetic risk assessment** is mandatory
  Martin et al. 2006
- Correct **3-D implant position** must be achieved
  Buser et al. 2004
- Facial **contour augmentation** with GBR is most often needed
  Buser et al. 2008
- **Primary wound closure** to protect applied biomaterials

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What are our Patients asking for?

- **Successful outcomes from an esthetic and functional point of view**
- **Esthetic outcomes with long-term stability**
- **A low risk of complications during healing and during function**

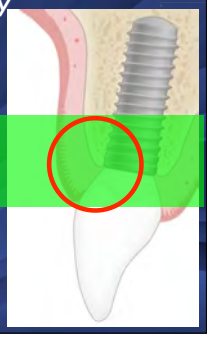
☞ **Primary Objectives of Implant Therapy**

- **The least number of surgical interventions**
- **The least possible pain and morbidity**
- **Short healing and overall treatment periods**
- **Treatment with good cost-effectiveness**

☞ **Secondary Objectives of Implant Therapy**

Important Objectives of Implant Surgery

- Successful osseointegration in the right prosthetic position
  - ✓Restoration-driven implant placement
- The implant must be completely imbedded in healthy bone
  - ✓Facial and oral bone walls should be at least 1 mm
  - ✓In case of a local bone deficiency –> GBR
- The implant must be surrounded by healthy keratinized mucosa



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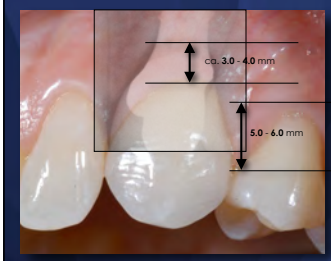
The concept of the **biologic width** around dental implants



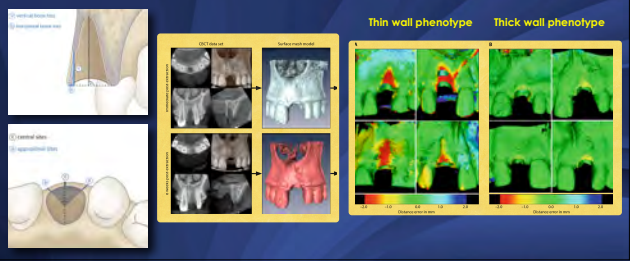
Berglundh, Lindhe: Dimension of the periimplant mucosa. Biological width revisited. J Clin Periodontol 23:971-973, 1996

Cochran, Hermann, Schenk, Higginbottom, Buser: Biologic width around titanium implants. A histometric analysis of the implanto-gingival junction around unloaded and loaded nonsubmerged implants in the canine mandible. J Periodontol 68:186-198, 1997

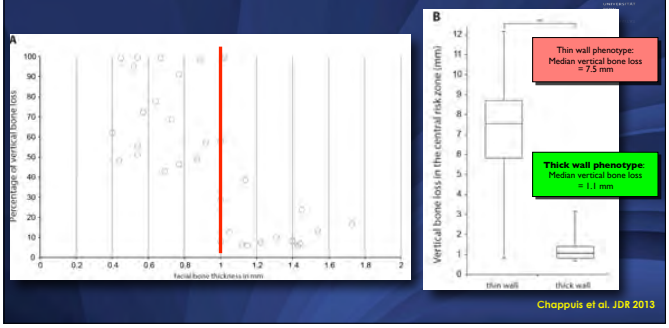
Kan, Rungcharassaeng, Umezu, Kois: Dimensions of peri-implant mucosa: an evaluation of maxillary anterior single implants in humans. J Periodontol 2003;74:557-562

Chappuis V, Engel O, Reyes M, Shahim K, Nolte LP, Buser D: Ridge alterations post extraction in the esthetic zone: A 3D analysis with CBCT. *J Dent Res* 92: 195S-201S, 2013

- Prospective case series study in 39 patients with a single tooth extraction in the max
- 2 CBCT's at day 0 and after 8 weeks of soft tissue healing



Regression Analysis in Central Sites for Vertical Bone Loss

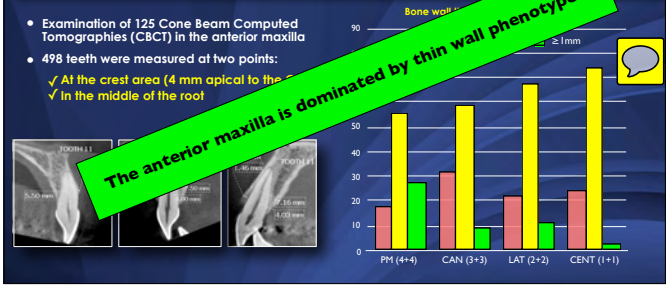


Chappuis et al. JDR 2013

Braut V, Bornstein MM, Belser UC, Buser D: Thickness of the facial bone wall at teeth in the anterior maxilla – A radiographic study in 125 patients using Cone Beam Computed Tomography. *Int J Periodont Rest Dent* 31:125–131, 2011

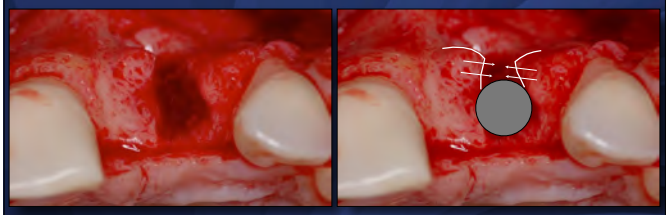
- Examination of 125 Cone Beam Computed Tomographies (CBCT) in the anterior maxilla
- 498 teeth were measured at two points:
  - ✓At the crest area (4 mm apical to the
  - ✓In the middle of the root

The anterior maxilla is dominated by thin wall phenotypes!



2-wall Defect:

Defect Regeneration very predictable and fast



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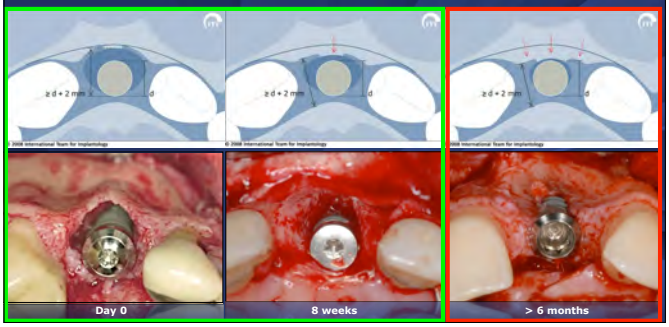
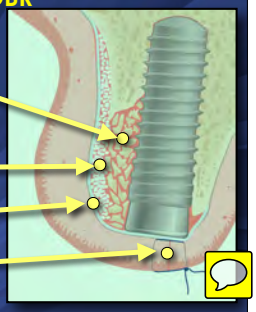
Ridge Alterations following Extraction: Timing is crucial!!



Contour Augmentation with GBR

Surgical Concept

- Autogenous bone chips to cover the exposed implant surface
  - To enhance new bone formation
  - To shorten healing periods
- HA based filler as 2nd layer on the facial aspect
  - To improve & maintain the facial contour
  - Must be a low-substitution filler like DBBM
- Resorbable collagen membrane
  - Acts as temporary barrier, keeps the fillers in place
  - No need for a 2nd open flap procedure
- Primary wound closure
  - Protects biomaterials
  - 8 weeks of healing



Buser et al. 2004, Buser et al. IJPRD 2008

TOPICS

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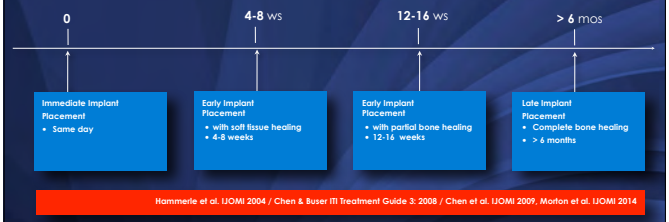
Implant Placement post Extraction

Treatment Options



Hammerle et al. IJOMI 2004 / Chen & Buser ITI Treatment Guide 3: 2008 / Chen et al. IJOMI 2009, Morton et al. IJOMI 2014

Periodontology 2000

PERIODONTOLOGY 2000

Implant placement post extraction in esthetic single tooth sites: when immediate, when early, when late?

Daniel Buser, Vivianne Chappuis, Urs C. Belser & Stephen Chen

In the first 25 years of modern implant dentistry based on the concept of osseointegration (15, 96), implant placement was predominantly performed in healed sites of fully edentulous patients (1, 16). Most of these patients had been edentulous for years and the utilization of dental implants was aimed at improving masticatory function and the quality of life. In the 1980s, the application of dental implants started to be cautiously expanded into partially edentulous patients as well, and the first reports were published with promising results (27, 28, 104). Since then, the percentage of partially edentulous patients in implant dentistry has significantly increased and today, these indications predominate in daily practice, in particular single tooth gaps (12, 19). In the case clinical experience of attending master clinicians, consensus statements and clinical recommendations have been developed by the ITI (36, 76, 86).

The goal of this review paper is to present a historical analysis of how the topic of implant placement post extraction has evolved over the years, and what clinical approaches are recommended today. The review is limited to single tooth extractions in the esthetic zone, since this is a very frequent indication for implant therapy today (18) and the majority of clinical research in post-extraction implant placement relates to this clinical indication of implant therapy (36, 39). Its structure is based on several time periods defined by review papers of ITI Consensus Conferences

Implant Placement post Extraction

Treatment Options

Hammerle et al. IJOMI 2004 / Chen & Buser ITI Treatment Guide 3: 2008 / Chen et al. IJOMI 2009, Morton et al. IJOMI 2014

Clinical and Esthetic Outcomes of Implants Placed in Postextraction Sites

Stephen T. Chen, BDS, MDSc, PhD[1]/Daniel Buser, DMD, Prof Dr Med Dent[2]

Purpose: *The aim of this review was to evaluate the clinical outcomes for the different time points of implant placement following tooth extraction.* ***Materials and Methods:*** *A PubMed search and a hand search of selected journals were performed to identify clinical studies published in English that reported on outcomes of implants in postextraction sites. Only studies that included 10 or more patients were accepted. For implant success/survival outcomes, only studies with a mean follow-up period of at least 12 months from the time of implant placement were included. The following outcomes were identified: (1) change in peri-implant defect dimension, (2) implant survival and success, and (3) esthetic outcomes.* ***Results and Conclusions:*** *Of 1,107 abstracts and 170 full-text articles considered, 91 studies met the inclusion criteria for this review. Bone augmentation procedures are effective in promoting bone fill and defect resolution at implants in postextraction sites, and are more successful with immediate (type 1) and early placement (type 2 and type 3) than with late placement (type 4). The majority of studies reported survival rates of over 95%. Similar survival rates were observed for immediate (type 1) and early (type 2) placement. Recession of the facial mucosal margin is common with immediate (type 1) placement. Risk indicators included a thin tissue biotype, a facial malposition of the implant, and a thin or damaged facial bone wall. Early implant placement (type 2 and type 3) is associated with a lower frequency of mucosal recession compared to immediate placement (type 1).* Int J Oral Maxillofac Implants 2009;24(suppl):186–217

Key words: *bone grafts, early implant placement, esthetics, immediate implant, implant survival*

Mucosal Recession with Immediate Implants

Publication	Year	Frequency	Remarks
Lindeborn et al.	2006	8.7% 30.0%	Recession 1. Re
Chen et al.	2007	33.3%	
Kan et al.	2007	34.8% 8.7%	e defects U-shape defects UU-shape defects
Evans & Chen			total of recessions ≥ 0.5 mm Recession 0.5-1.0 mm Recession 1.0-1.5 mm Recession >1.5 mm
	2008	0.5 mm 25%	mean Recession Recession ≥ 1.5 mm
al.	2009	44.8% 13.8%	Recession 1.0 - 1.99 mm Recession ≥ 2 mm

Immediate Implants have a 20 to 30% risk of mucosal recession (> 1 mm), if applied without inclusion criteria

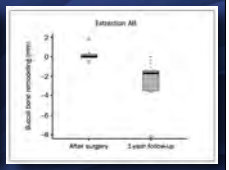
Several CBCT Studies on Immediate Implants showed a significant Resorption of the Facial Bone Wall

Miyamoto et al., IJPRD 2011	57% without facial wall
Benic et al., COIR 2012	36% without facial wall
Kuchler et al. COIR 2015	24% without facial wall
Vera et al. IJOMI 2012	46% without facial wall 1.7 mean vertical bone loss
Roe et al. IJOMI 2012	0.9 mm mean vertical bone loss

Vera C, De Kok IJ, Chen W, Reside G, Tyndall D, Cooper LF: Evaluation of Post-implant Buccal Bone Resorption Using Cone Beam Computed Tomography: A Clinical Pilot Study. *Int J Oral Maxillofac Implants* 27: 1249-57, 2012

Table 1 Qualitative Assessment of the Ability to See Facial Bone in a CBCT Image, Both After Surgery and 1 Year Later, For Each of the Three Measurement Locations: C, F, and G

	No. of patients	C	F	G
After surgery				
Healed ridge	8	8/8	6/8	6/8
Extraction site	7	7/7	7/7	6/7
1 year after implant placement				
Healed ridge	8	8/8	6/8	6/8
Extraction site	7	4/7	4/7	5/7



Kan JYK, Rungcharassaeng K, Lozada JL, Zimmerman G: Facial Gingival Tissue Stability Following Immediate Placement and Provisionalization of Maxillary Anterior Single Implants: A 2- to 8-Year Follow-up. *Int J Oral Maxillofac Implants* 26:179–187, 2011

- 35 patients with immediate implants were followed up to 8 years
- Thin gingival biotypes showed an increased risk for mucosal recession
- 3 Patienten requiered a resurgery to improve the anesthetic situation

Table 5 Comparison of Mean Facial Gingival Level Changes in Sites with Thick or Thin Biotypes During the Study Period ($\alpha = .05^{\dagger}$)

	Gingival biotype			
Time interval	All (n = 35)	Thick (n = 14)	Thin (n = 21)	P*
T0–T2	−0.55 ± 0.55	−0.25 ± 0.33	−0.75 ± 0.59	.007
T0–T3	−1.13 ± 0.87	−0.56 ± 0.46	−1.50 ± 0.88	.0008
P**	< .001	.001	< .001	

†A significant interaction was observed between biotype and time interval (repeated-measures ANOVA; P = .03).
*Comparison between thick and thin biotypes only (independent t test); **comparison between T0–T2 and T0–T3 (paired t test).

Cosyn J, Eghbali A, Hermans A, Vervaecke S, De Bruyn H: A 5-year prospective study on singleimmediate implants in the aesthetic zone. *J Clin Periodont* 43:702, 2016

Background, Materials and Methods

- Very serious and experienced group from the University of Gent
- These are 5-year results of a prospective case series study with immediate implant placement with immediate restoration
- Only patients with an intact facial bone wall were included
- The defect space was grafted with DBBM
- 1- and 3-year data has been published
- The 5-year data was obtained from 17 patients

Results

- 8 out of 17 patients developed an advanced mucosal recession of ≥1.0 mm, three after the 3rd year.

Table 2. Vertical soft tissue changes around single immediate implants

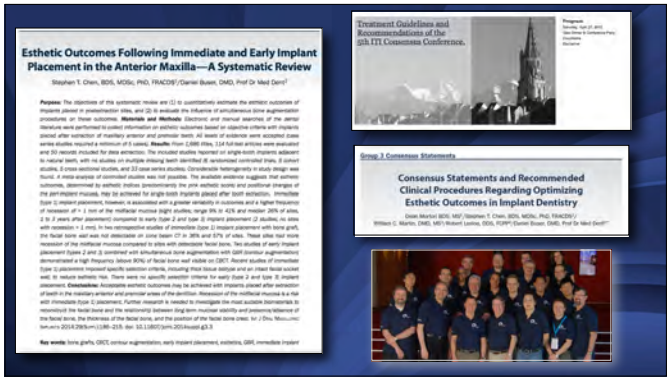
Parameter	1 year (n = 20)	5 years (n = 17)	p-value*
Mesial papillary recession (mm)	**0.22 (0.58)** *0 (0; 5)* [−1; 1]	**−0.09 (0.33)** *0 (0; 0)* [−1; 0.5]	0.007
Distal papillary recession (mm)	**0.50 (0.48)** *0.5 (0; 0.5)* [0; 1.5]	**0.25 (0.45)** *0 (0; 0.5)* [0; 1.5]	0.006
Mid-facial recession (mm)	**0.28 (0.48)** *0.25 (0; 0.5)* [−0.5; 1]	**0.53 (0.53)** *0.5 (0.25; 1)* [−0.5; 1.5]	0.072

Table 3. Mid-facial recession at single immediate implants sorted per implant location

Implant location	1 year	5 years
Central incisor	0.28 ($n = 9$)	0.88 ($n = 8$)
Lateral incisor	0.25 ($n = 6$)	0.30 ($n = 5$)
Cuspid	0.50 ($n = 1$)	1.00 ($n = 1$)
Pre-molar	0.00 ($n = 4$)	0.17 ($n = 3$)

Cosyn J, Eghbali A, Hermans A, Vervaecke S, De Bruyn H: A 5-year prospective study on singleimmediate implants in the aesthetic zone. *J Clin Periodont* 43:702, 2016

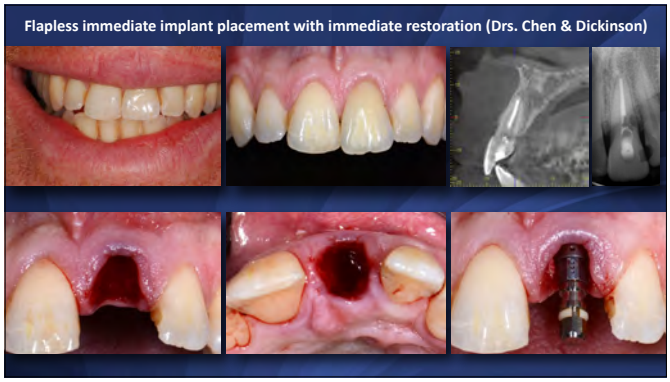
Conclusion: Single immediate implants showed high implant survival and limited marginal bone loss in the long term. However, mid-facial recession, mid-facial contour and alveolar process deficiency deteriorated after 1 year. With an aesthetic complication rate of 8/17 in well-selected patients who had been tr[illegible] by experienced clinicians, type I placement may not be recommended for daily practice.

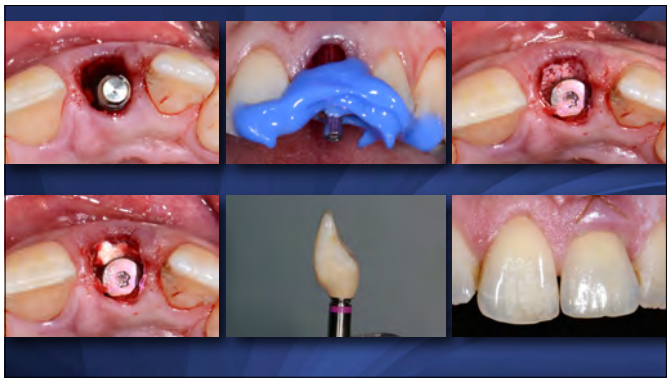


ITI Treatment Guidelines (2013)

- **With immediate placement (type 1), a high level of clinical competence and experience in performing the treatment is needed**
- **Careful case selection is required to achieve satisfactory esthetic outcomes.**

- **The following clinical conditions should be satisfied:**
  - ✓ Intact socket walls
  - ✓ Facial bone wall of at least 1 mm in thickness
  - ✓ Thick soft tissue biotype
  - ✓ No acute infection at the site
  - ✓ The availability of bone apical and palatal to the socket to provide primary stability

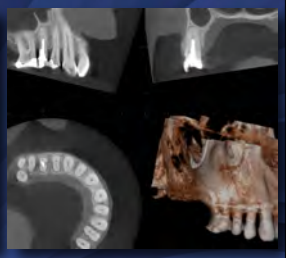


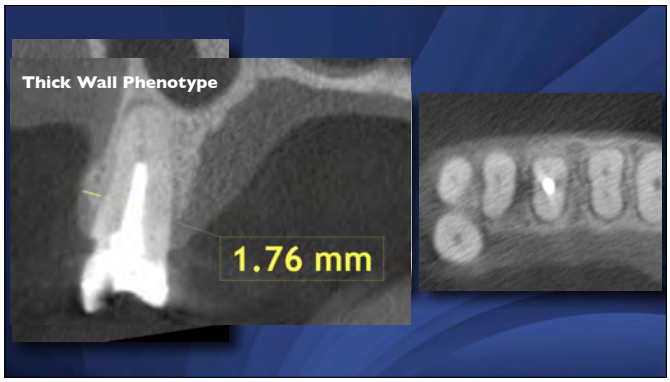


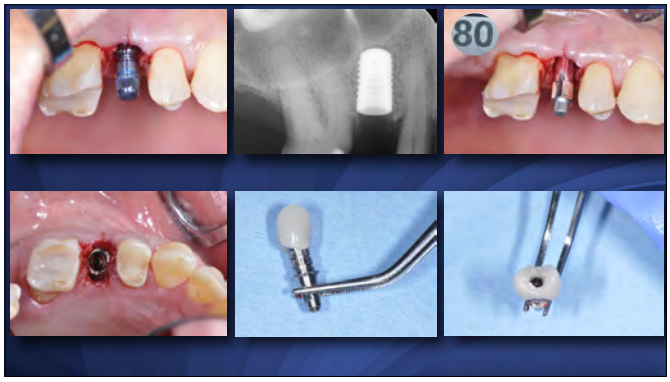
Pilot Trial of 10 cases with the immediate-immediate Approach

- **Very strict case selection for single tooth replacement**
  - ✓ Only extraction sites with an intact facial bone wall und a thick wall phenotype
  - ✓ No acute infection or fistula
- **Immediate implant placement, flapless approach**
- **Implant insertion with CAIS (computer-assisted implant surgery)**
  - ✓ That should allow an optimal 3D implant position and axis
- **Internal grafting of the gap between the bone wall and the implant surface**
  - ✓ Bone Ceramic as low-substitution filler
- **Immediate restoration with a single crown**
  - ✓ No occlusal contact, the crown is just for smiling
  - ✓ Seals off the tissue defect in the crestal area

48-year old female,
referred by dentist for extraction 15 and implant placement



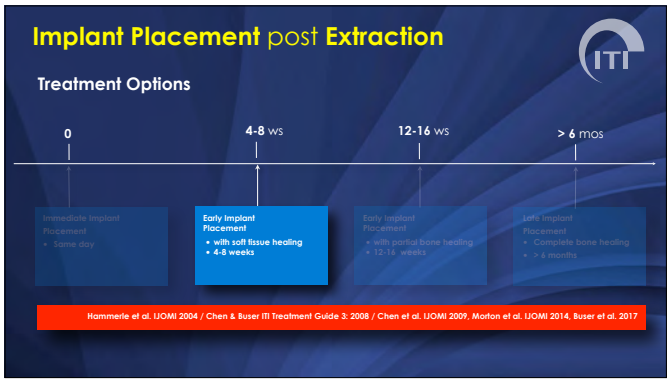




8 weeks post surgery

Implant Placement post Extraction

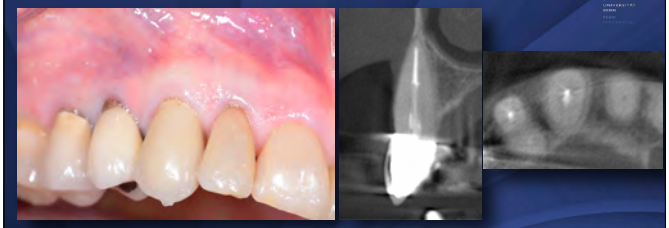
Treatment Options



Buser, Chen, Weber, Belser: The Concept of Early Implant Placement following Single Tooth Extraction in the Esthetic Zone. Biologic Rationale and Surgical Procedures.
***Int J Periodont Rest Dent* 28: 440-451, 2008**

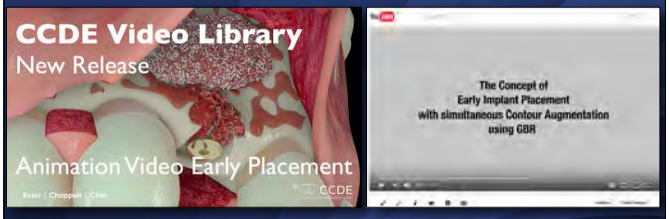
- Paper of methodology
- Clinical rationale for ear[illegible]ant placement
- Case report with step-by-step procedure

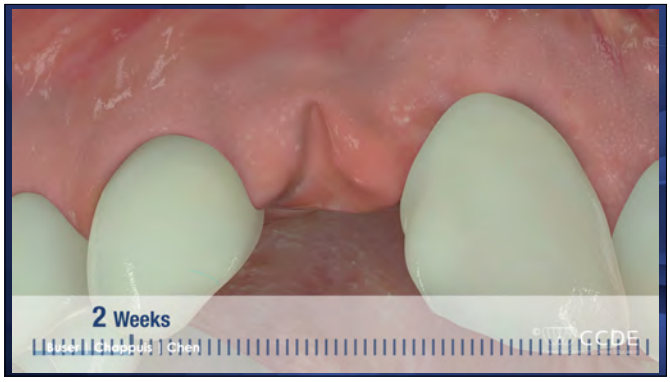
Female Patient, age 73, former implant tx (>10 yrs), healthy, non-smoking



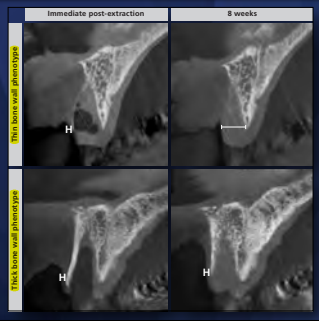
- The adjacent teeth are compromised with recessions
- The facial bone wall is very thin and will be entirely resorbed within 2 weeks
- The crest width, however, is more than 6 mm which will provide a 2-wall defect
- This defect morphology is favorable for predictable contour augmentation

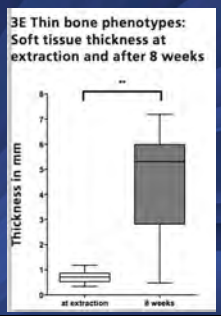
- Careful tooth extraction without flap elevation
  - ✓ Degranulation
  - ✓ Utilization of a collagen plug to stabilize the coagulum
- A soft tissue graft with the punch technique is not used in sta[illegible] cases
- Goals of 4-8 weeks of healing
  - ✓ Get an intact mucosa and increase the keratinized mucosa by 3-5 mm
  - ✓ Let the bundle bone resorb during this healing period to go through the osteoclastic activity
  - ✓ Get a spontaneous soft tissue thickening to get a thicker flap for surgery
  - ✓ If present, infections and fistulas will clear





Chappuis, Engel, Reyes, Shahim, Katsaros, Buser: Soft tissue alterations in esthetic post extraction sites - a 3D analysis J Dent Res 94 (Suppl): 187S-93S, 2015





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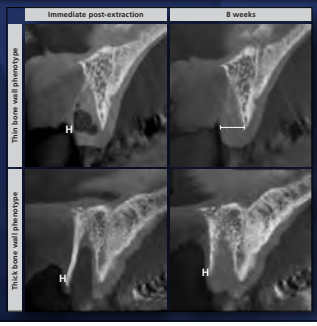

- The spontaneous Soft Tissue Thickening is a clinical advantage
  - ➡ Thicker flap for implant surgery
  - ➡ Better vascularity of the flap
  - ➡ No need for Connective Tissue Grafting in routine cases

Incision and Flap Designs for Single Tooth Gaps

Papilla sparing incision and trapezoidal flap design

Sulcular incision and trapezoidal flap design

Sulcular incision and triangular flap design

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Papilla sparing incision and trapezoidal flap design

Advantages

- Papillae are not elevated
  - ✓ Slightly less bone resorption at the crystal area of adjacent teeth

Disadvantages

- Small flap
  - ✓ Vascularity reduced
- With contour augmentation, the flap is too small
  - ✓ High risk for scarring

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Sulcular incision and trapezoidal flap design

Advantages

- Large flap
  - ✓ Excellent vascularity
  - ✓ Good coverage of contour augmentation

Disadvantages

- Two releasing incisions inside the esthetic frame
  - ✓ Risk for visible scars
- Papillae are elevated
  - ✓ Light resorption of bone due to surgical trauma

Sulcular incision and triangular flap design

Advantages

- Large flap
  - ✓ Excellent vascularity
  - ✓ Good coverage of contour augmentation
- Only one releasing incision outside the esthetic frame
  - ✓ Minimal risk for disturbing scar

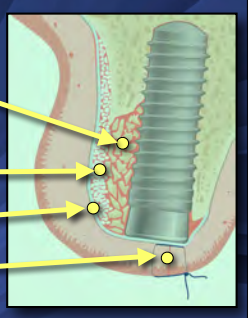
Disadvantages

- Papillae are elevated
  - ✓ Light resorption of bone due to surgical trauma

Contour Augmentation with GBR

Surgical Concept since 1998

- Autogenous bone chips to cover the exposed implant surface
  - To enhance new bone formation
  - To shorten healing periods
- HA based filler as 2nd layer on the facial aspect
  - To improve & maintain the facial contour
  - Must be a low-substitution filler like DBBM
- Resorbable collagen membrane
  - Acts as temporary barrier, keeps the fillers in place
  - No need for a 2nd open flap procedure
- Primary wound closure
  - Protects applied biomaterials
  - 8 weeks of healing



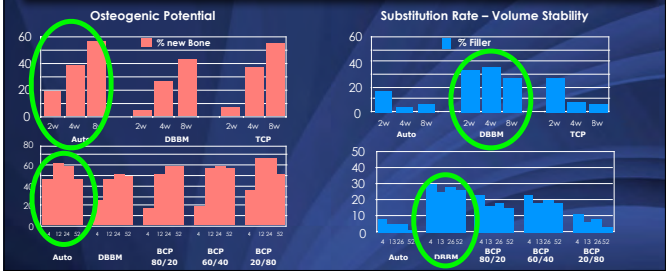
Buser et al. 2004, Buser et al. IJPRD 2008

Why this combination of autogenous bone chips and DBBM (Bio-Oss®)?

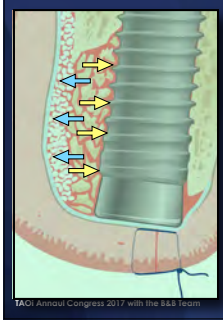
- Bone fillers support the collagen membrane
- Autografts accelerate new bone formation in the defect area
- DBBM increases the augmentation volume and provides better volume stability due to their low substitution rate

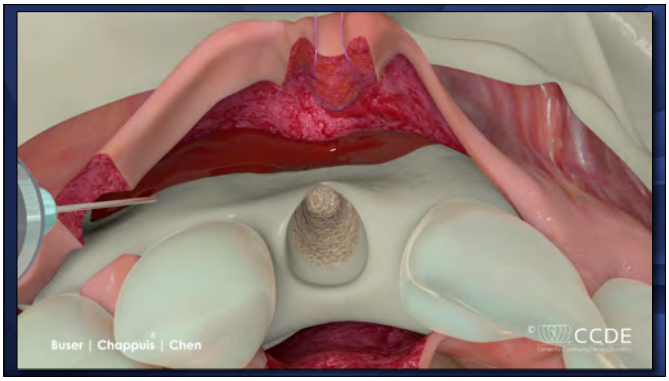
Jensen, Broggini, Hjørting-Hansen, Schenk, Buser: Bone healing and graft resorption of autografts, anorganic bovine bone and β-TCP. *Clin Oral Impl Res* 17:237-243, 2006

Jensen SS, Bornstein MM, Dard M, Bosshardt D, Buser D: Comparative study of biphasic calcium phosphates with different HA/TCP ratios in mandibular bone defects. A long-term histomorphometric study in minipigs. *J Biomed Mater Res* B 90:171-181, 2009

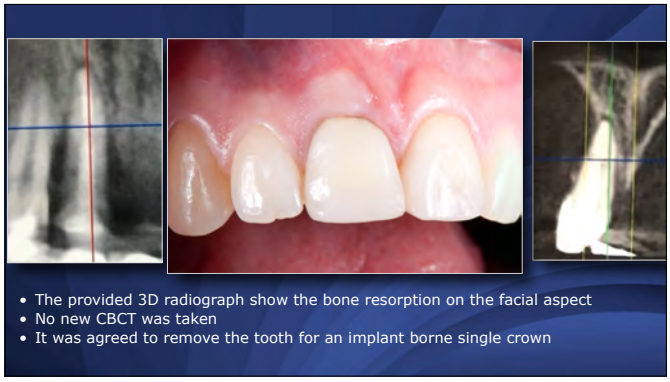


The **Important Role** of **Autogenous Bone Chips**





- 22-year old female patient, healthy, non-smoking
- Patient had a dental trauma with tooth 11, which was then crowned
- Now, tooth 11 is cuasing problem and has increased probing depth



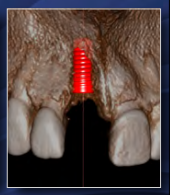
- The provided 3D radiograph show the bone resorption on the facial aspect
- No new CBCT was taken
- It was agreed to remove the tooth for an implant borne single crown

- The post extraction healing was delayed, no alveolitis
- Last week, we took a CBCT to document the local anatomy

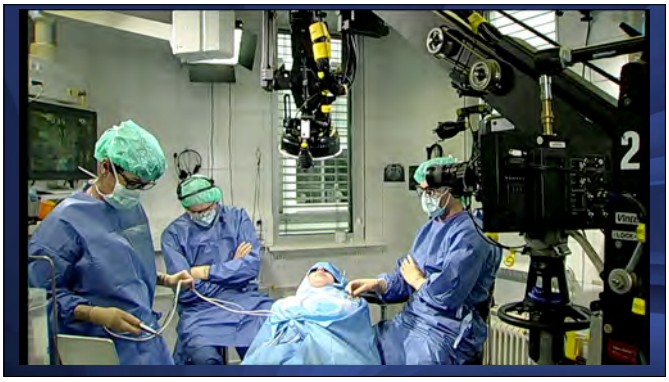
- The CBCT shows in all details the anatomic situation

- The bone height at adjacent teeth is good
- The crest width excellent





- As expected, the facial wall is resorbed and will be regeneretad with contour augmentation
- Now, the patient has a thick soft tissue flap



- 8 weeks post extraction
- We still a small invagination of 2 mm


Cell Biology Research on Bone Conditioned Medium: Most interesting Data!

Miron, Hedbom, Saulacic, Zhang, Sculean, Bosshardt, Buser: Osteogenic potential of autogenous bone grafts harvested with four different surgical techniques. J Dent Res 90; 1428-1433, 2011

Miron, Gruber, Hedbom, Saulacic, Zhang, Sculean, Bosshardt, Buser: Impact of bone harvesting techniques on cell viability and the release of growth factors of autografts. *Clin Implant Dent Relat Res* 15: 481-89, 2013

Kuchler, Schmid, Buser, Gruber: The shape of a bone scraper: an in vitro pilot study using p cine b e chips. Int J Oral Maxillofac Surg 43: 879, 2014

Caballé-Serrano, Bosshardt, Buser, Gruber: Proteomic Analysis of Porcine Bone-Conditioned Oral Maxillofac Implants 29:1208, 2014

Peng, Nemec, Brolese, Bosshardt, Schaller, Buser, Gruber: Bone-conditioned medium inhibits osteogenic and adipogenic differentiation of mesenchymal cells in vitro. Clin Implant Dent Rel Res 17:938-49, 2015

Caballé-Serrano, Sawada, Schuldt Filho, Bosshardt, Buser, Gruber: Bone conditioned medium: preparation and bioassay. J Vis Exp. 8; (101):e52707, 2015

Zimmermann, Caballé-Serrano, Bosshardt, Ankersmit, Buser, Gruber: Bone-conditioned medium changes gene expressiopn in bone-derived fibroblasts. Int J Oral Maxillofac Implants. 30:953-958, 2015

Brolese, Buser, Kuchler, Schaller, Gruber: Human bone chips release of sclerostin and FGF-23 into the culture medium: an in vitro pilot study. Clin Oral Implants Res 26:1211-4, 2015

Caballé-Serrano, Schuldt Filho, Bosshardt, Gargallo-Albiol, Buser, Gruber: Conditioned m fresh and demineralized bone enhances osteoclastogenesis in murine bone marrow. Clin Oral Implants Res. 27:226-32, 2016

Caballé-Serrano, Fujioka-Kobayashi, Bosshardt, Buser, Miron: Pre-coating deproteinized bovine b e mineral (DBBM) with bone-conditioned medium (BCM) improves osteoblast migration, adhesion and differentiation in vitro. C stig. 20:2507-2513, 2016

Fujioka-Kobayashi M, Caballé-Serrano J, Bosshardt, Gruber, Buser, Miron: Bone conditio (BCM) improves osteoblast adhesion and differentiation on collagen barrier membranes. BMC Oral Health. 17:7, 2016

Caballé-Serrano, Sawada, Miron, Bosshardt, Buser, Gruber: Collagen barrier membranes adsorb growth factors liberated from autogenous bone chips. Clin Oral Implants Res. 28: 236-241, 2017

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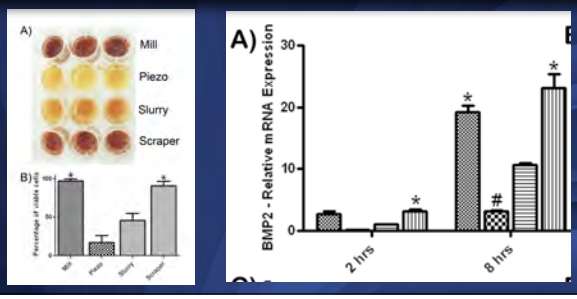
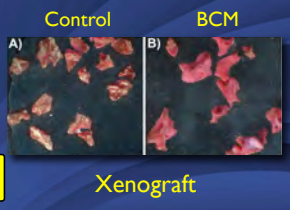
Miron, Gruber, Hedbom, Saulacic, Zhang, Sculean, Bosshardt, Buser: Impact of bone harvesting techniques on cell viability and the release of growth factors of autografts. *Clin Implant Dent Relat Res* 15: 481-89, 2013



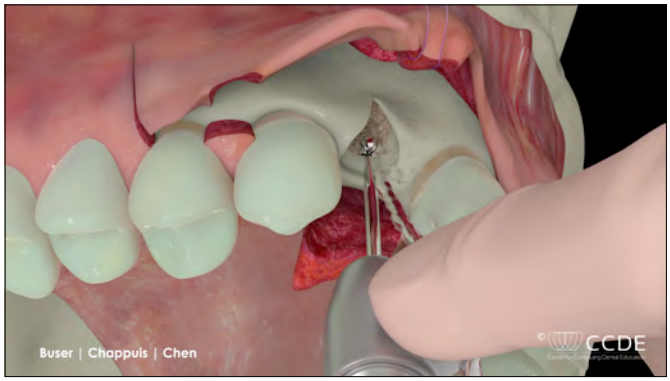
Caballé-Serrano, Fujioka-Kobayashi, Bosshardt, Buser, Miron: Pre-coating deproteinized bovine bone mineral (DBBM) with bone-conditioned medium (BCM) improves osteoblast migration, adhesion and differentiation *in vitro*. *Clin Oral Investig. 20:2507-13, 2016*

Caballé-Serrano, Sawada, Miron, Bosshardt, Buser, Gruber: Collagen barrier membranes adsorb growth factors liberated from autogenous bone chips. Clin Oral Implants Res. 28: 236-241, 2017

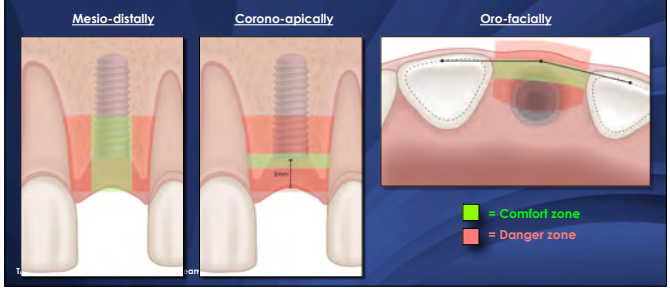
- Biomaterials can be incubated with M to emulate a clinical scenario, ich autogenous bone chips would combined with a xenograft
- Xenograft plus BCM increased migration, adhesion and mineralization capacity of pre-osteoblasts
- Natural collagen barrier membranes retain growth factors liberated from autogenous bone grafts

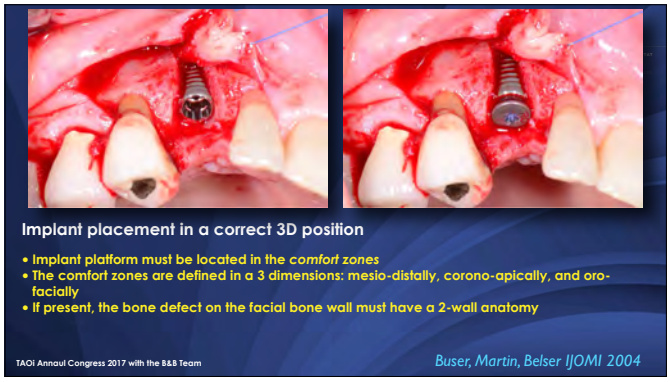


Xenograft



Buser, Martin, Belser: Optimizing esthetics for implant restorations in the anterior maxilla: Anatomic and surgical considerations.
Int J Oral Maxillofac Implants 19 (Suppl 1): 43, 2004

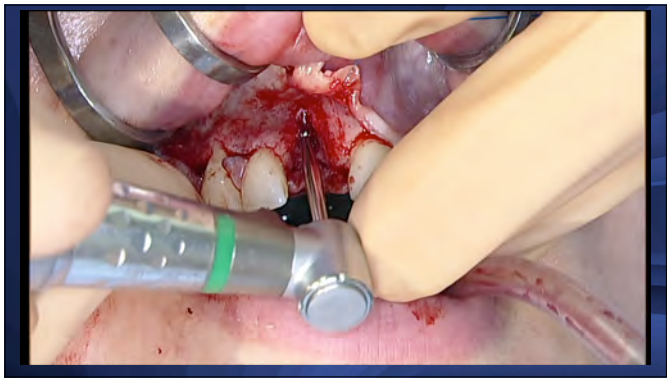


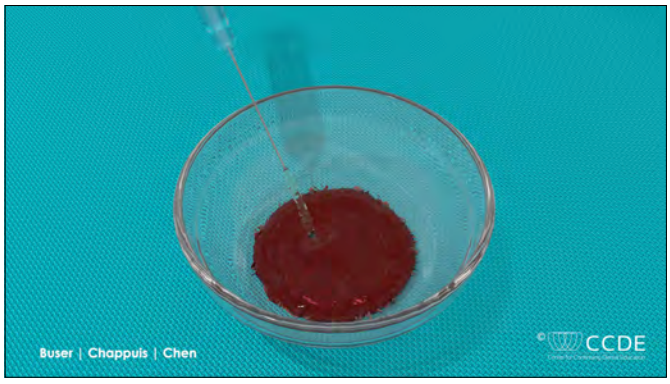


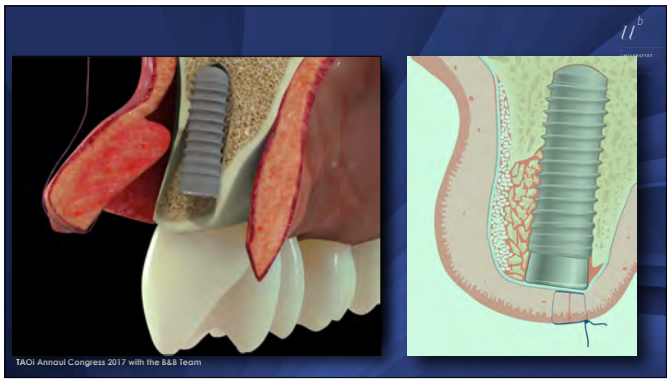
Implant placement in a correct 3D position

- Implant platform must be located in the *comfort zones*
- The comfort zones are defined in a 3 dimensions: mesio-distally, corono-apically, and oro-facially
- If present, the bone defect on the facial bone wall must have a 2-wall anatomy

Buser, Martin, Belser IJOMI 2004







Clinical Advantages of Collagen Membranes (Bio-Gide®)

- **Hydrophilic and easy to apply** → Very user friendly
- **Temporary barrier function and wound draping effect** → Keeps bone fillers in place
- **Bioabsorbable** → No need for membrane removal, no 2nd open flap procedure

---

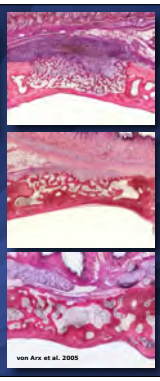
Hürzeler, Kohal, Naghshbandi, Mota, Conradt, Hutmacher, Caffesse: Evaluation of a new bioresorbable barrier to facilitate guided bone regeneration around exposed implant threads. An experimental study in the monkey. *Int J Oral Maxillofac Surg*. 27:315-20, 1998

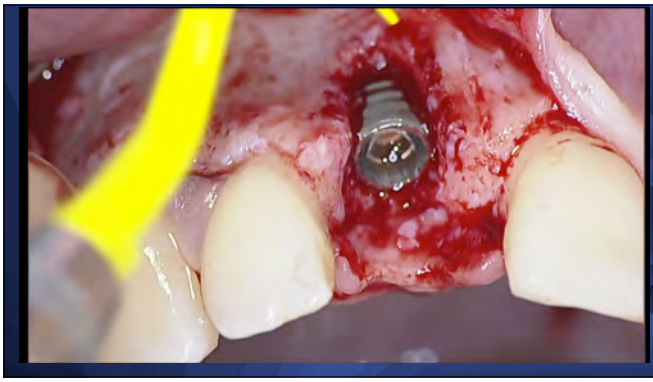
von Arx, Broggini, Jensen, Schenk, Buser: Membrane durability and tissue response to prototype collagen barrier membranes: a histologic study in the rabbit calvaria. *Int J Oral Maxillofac Implants* 20:843-853, 2005

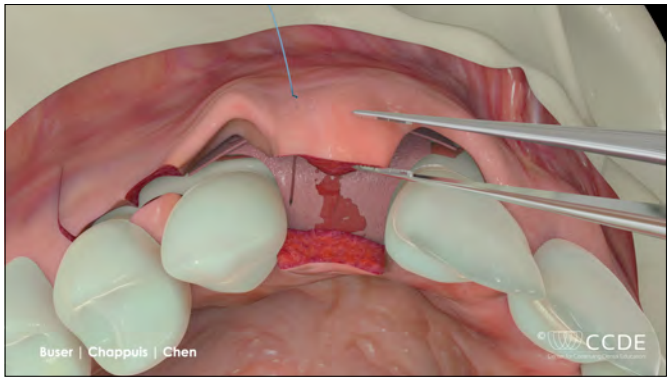
- **Non-crosslinkes collagen membranes are biocompatible and well tolerated by the tissues**
- **The membrane must be supported by an appropriate filler to avoid a collapse**
- **The barrier function only lasts 6-8 weeks**

Advantages of collagen membranes

- → The membrane is easy to handle due to its hydrophilic nature
- → In routine cases, no need for fixation pins
- → Low complication rate
- → No need for a 2nd open flap procedure to remove the membrane

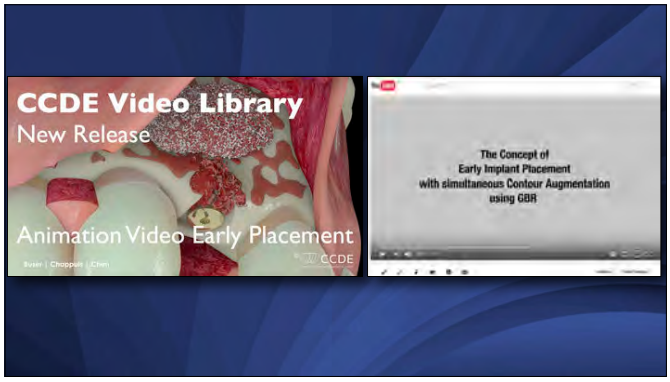


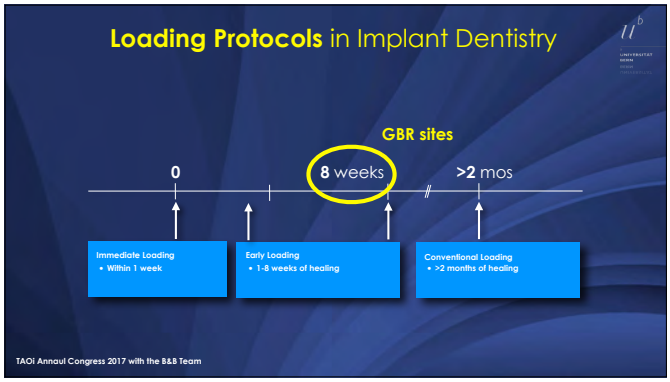




Tension-free Primary Wound Closure

- **Flap mobilization with periosteal incision and coronal displacement** → Avoid flap tension
- **Primary wound closure** → Submerged membrane and augmentation material
- **Most important advantage** → A successful regenerative outcome is more predictable


CCDE Video Library
New Release
Animation Video Early Placement
Buser | Chappuis | Chen
CCDE
The Concept of
Early Implant Placement
with simultaneous Contour Augmentation
using GBR


Loading Protocols in Implant Dentistry
GBR sites
0
8 weeks
>2 mos
Immediate Loading
• Within 1 week
Early Loading
• 1-8 weeks of healing
Conventional Loading
• >2 months of healing
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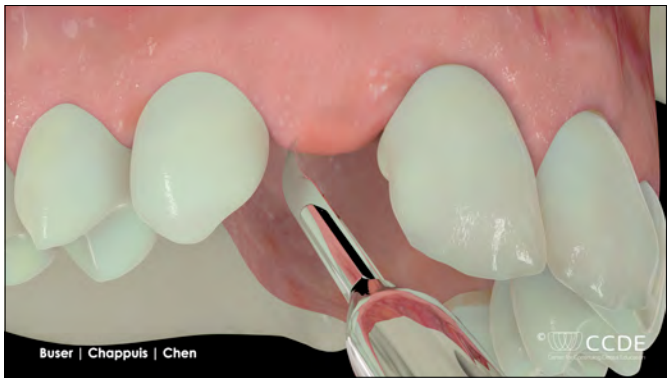
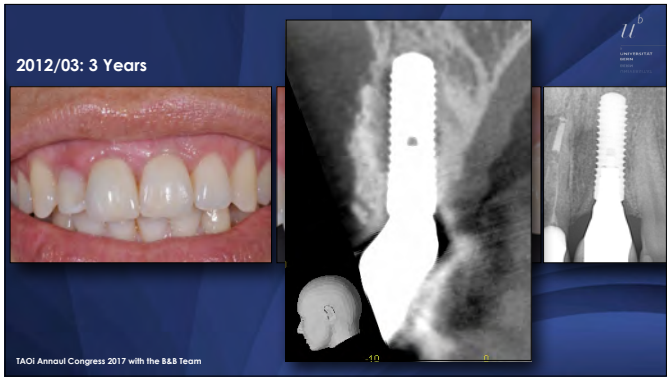

Buser | Chappuis | Chen
CCDE

Case analysis

- Patient had a flap-less extraction
- 2 months of soft tissue healing
- [illegible]t had one open flap surgery to perform implant [illegible]acement with Contour Augmentation
- [illegible] weeks of healing
- Reopening with a punch
- No bone graft harvesting at the chin/retromolar
- No CT grafting due to a thick flap
- Low risk of complication as documented by several studies
- Excellent long-term stability of the facial bone wall


2012/03: 3 Years
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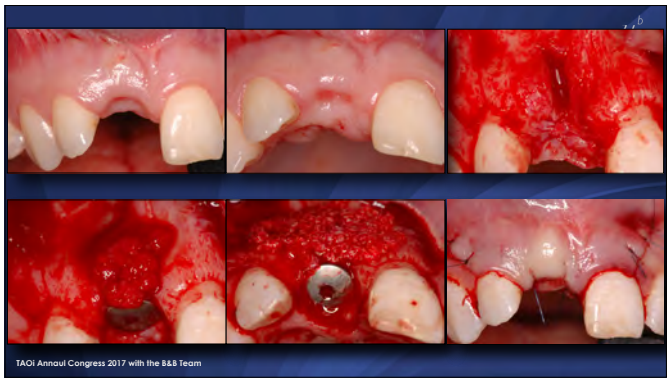
2016: 7 Years (Implant 21)
TAOi Annaul Congress 2017 with the B&B Team


2005: Single tooth gap in a young female, post-trauma situation
TAOi Annaul Congress 2017 with the B&B Team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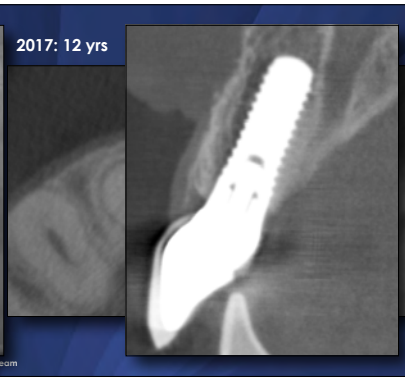
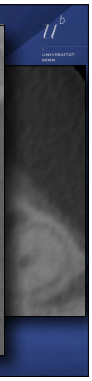
2006

2017: 12 yrs

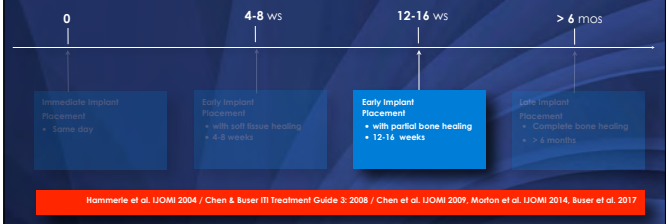
2017: 12 yrs





Implant Placement post Extraction

Treatment Options



Hammerle et al. IJOMI 2004 / Chen & Buser ITI Treatment Guide 3: 2008 / Chen et al. IJOMI 2009, Morton et al. IJOMI 2014, Buser et al. 2017

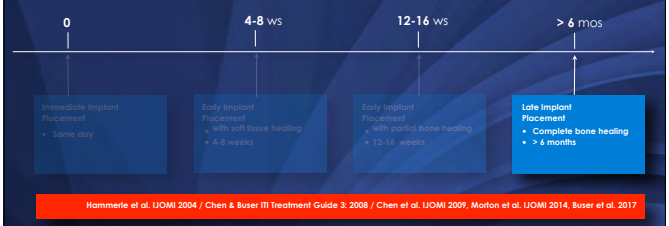
Implant Placement post Extraction

Early Implant Placement (Type 3)

- In cases, when bone lesions do not allow sufficient primary implant stability
  - ✓ Periapical pathologies
- In sites without risk for buccal flattening within 4 months
  - ✓ First molars in the mandible or maxilla
  - ✓ To wait 3-4 months often allows implant placement without bone grafting procedures (–> reduction of cost)

Implant Placement post Extraction

Treatment Options



Hammerle et al. IJOMI 2004 / Chen & Buser ITI Treatment Guide 3: 2008 / Chen et al. IJOMI 2009, Morton et al. IJOMI 2014, Buser et al. 2017

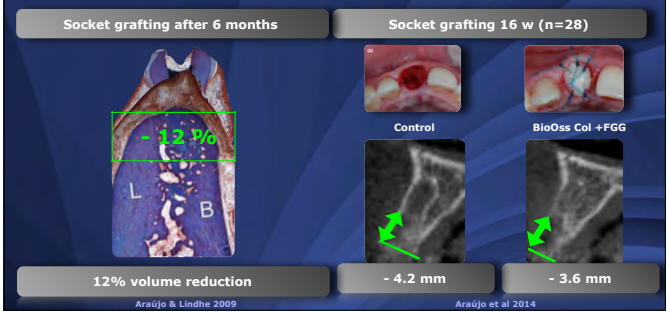
ITI Treatment Guidelines (2013)

- If these conditions are not met, Type 1 implant placement is not recommended.
- The above mentioned pre-conditions for immediate placement (type 1) are rarely present. Thus, early implant placement (type 2) is the option of choice in most instances. If, however, it is anticipated that primary stability cannot be achieved, the post-extraction healing period should be extended.
- Ridge preservation/augmentation procedures may be considered when implant placement needs to be delayed for patient or site related reasons.

What about Ridge Preservation Techniques

- Socket grafting for ridge preservation is well documented today
- However, there is no need for ridge preservation, when early implant placement is feasible
- Socket grafting requires at least 4 to 6 months of healing to get a good osseous healing
  - ✓ That's not attractive for patients in routine situations
- Socket grafting is done with a low-substitution bone filler
  - ✓ BioOss collagen

Dimensional Ridge Alterations



Araújo & Lindhe 2009 — Araújo et al 2014

Conclusions: Ridge Preservation Techniques

- Socket grafting with Bio-Oss for ridge preservation is well documented today
- Socket grafting will reduce the amount of bone resorption
- However, in the crestal area, bone will still be resorbed
  - ✓ Bundle bone resorption
- With this technique, significant bone volume reduction can be avoided
  - ✓ Ridge augmentation with staged approach can be avoided
- Ridge preservation with socket grafting is the treatment of choice, when late implant placement is indicated
- Late implant placement will require in most cases a simultaneous GBR procedure to optimize the esthetic outcome

Implant Placement post Extraction

Late Implant Placement (Type 4)

- In cases, when extended bone lesions do not allow sufficient primary implant stability with a Type 1, 2 or 3 approach
  - ✓ Large periapical pathologies like cysts
  - ✓ In sites with reduced bone height due to sinus floor
- In adolescent patients being too young for implant placement
  - ✓ <18 years of age
  - ✓ Ridge preservation techniques are highly recommended

2011: 2 yrs

2016: 6 yrs

TOPICS

- Short introduction
- Treatment options: When immediate, when early, when late?
- **Long-term results of early implant placement with contour augmentation**
- Conclusions

Scientific Documentation of Contour Augmentation

Buser, Bornstein, Weber, Grütter, Schmid, Belser: Early Implant Placement with GBR following Single Tooth Extraction in the Esthetic Zone: A cross-sectional, retro-spective Study in 45 Patients with a 2-4 year Follow-up. *J Periodontol 79: 1773-1781, 2008*

Buser, Halbritter, Hart, Bornstein, Grütter, Chappuis, Belser: Early Implant Placement following Extraction of Single Teeth in the Esthetic Zone: A prospective Study in 20 Patients. *J Periodontol 80:151-162, 2009*

Buser, Wittneben, Bornstein, Grütter, Chappuis, Belser: Stability of Contour Augmentation and Esthetic Outcomes of Implant Supported Single Crowns in the Esthetic Zone. 3-Year Results of a Prospective Study with Early Implant Placement Post Extraction. *J Periodontol 82:342-349, 2011*

Buser, Chappuis, Wittneben, Bornstein, Frei, Belser: Stability of Early Implant Placement with GBR following Single Tooth Extraction in the Esthetic Zone: A prospective, cross-sectional Study with a 5-8 year Follow-Up. *J Periodontol 84:1517-27, 2013*

Buser, Chappuis, Kuchler, Bornstein, Wittneben, Buser, Cavusoglu, Belser: Long-term Stability of Early Implant Placement with Countour Augmentation. *J Dent Res 92: 176S-182S, 2013*

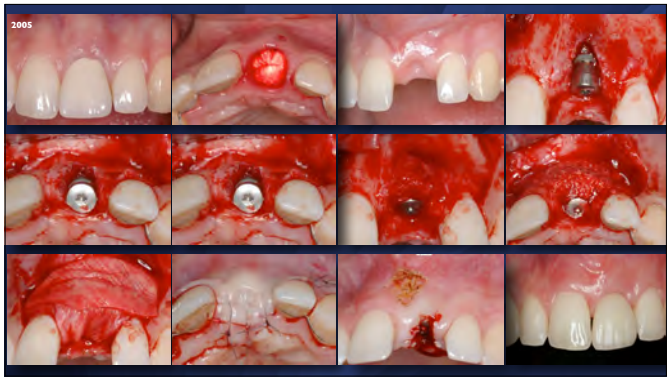
Jensen S, Bosshardt DD, Gruber R, Buser D: Long-term stability of contour augmentation in the esthetic zone. Histologic and histomorphometric evaluation of 12 human biopsies after 14 to 80 months of healing. J Periodontol 85:1549-56, 2014

Chappuis V, Rahman L, Buser R, Janner S, Belser UC, Buser D: 10-Year Stability of Early Implant Placement with Contour Augmentation in Esthetic Single Tooth Sites *(in manuscript)*

Chappuis V, Rahman L, Buser R, Janner S, Belser UC, Buser D: 10-Year Stability of Early Implant Placement with Contour Augmentation in Esthetic Single Tooth Sites *(in manuscript)*

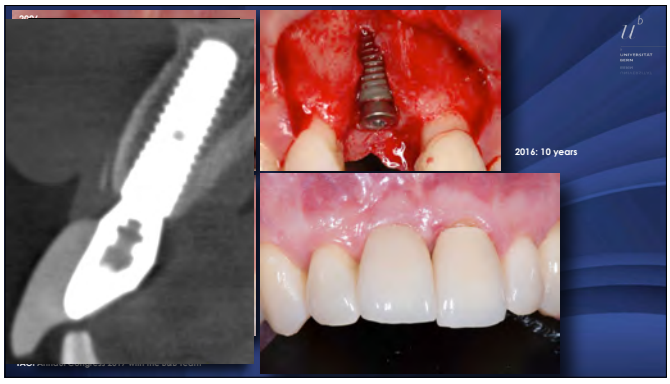
Material & Methods

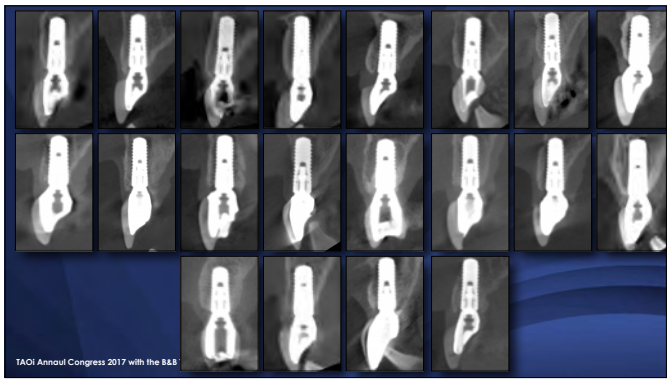
- All 20 patients with a single tooth replacement post extraction in the esthetic zone have been examined
  - ✓ No drop-outs over 10 years!
- Clinical examinations at 10 year exam
  - ✓ Typical peri-implant soft tissue and esthetic parameters
  - ✓ Radiographic bone crest levels
  - ✓ 4x4 cm Cone Beam Computed Tomographies (Accuitomo, Morita) for the measurement of the facial bone wall thickness
- In all patients, the 10 year follow-ups look very good and very stable
- The data has been presented the 1st time at the *2nd International Symposium on Regeneration and Esthetics* in Bern by Vivianne Chappuis (Nov 18/19, 2016)


2005


2016/10: 10 yrs


2006
2016/10: 10 Years


2016: 10 years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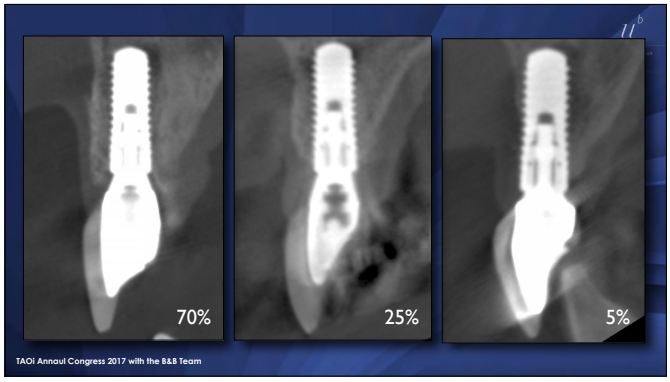


Thickness of Facial Bone Wall at various levels (in mm)

		at 0 mm	at 2 mm	at 4 mm	at 6 mm
6 years – 2012	Min	0.00	0.22	0.14	0.19
	Max	2.24	2.89	2.81	3.73
	Mean	**1.05**	**1.75**	**1.96**	**1.93**
10 years – 2016	Min	0.00	0.00	0.00	0.12
	Max	2.03	2.81	2.82	3.73
	Mean	**0.96**	**1.68**	**1.89**	**1.90**

Conclusions

- The mean thickness of the facial bone wall was around 2 mm at 10 years of function
- 19 out of 20 implants showed a facial bone wall
- The remaining implant is clinically healthy, but must be considered at risk (5%).

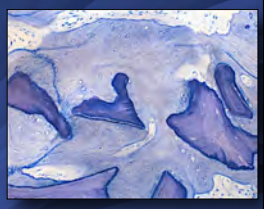
Open Questions concerning the facial Bone Wall

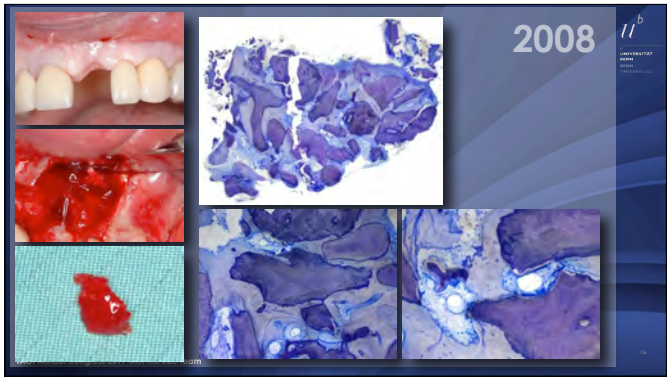
- How can we optimize an intact facial bone wall coronal to the implant shoulder?
- What is present in the facial bone wall?
  - Is it vital bone with osseointegrated DBBM particles?
  - What's the volume percent of DBBM particles in this bone wall?

Jensen S, Bosshardt DD, Gruber R, Buser D: Long-term stability of contour augmentation in the esthetic zone. Histologic and histomorphometric evaluation of 12 human biopsies after 14 to 80 months of healing. J Periodontol 85:1549-56, 2014

Material & Methods

- Bone biopsies from 10 patients with 12 implants
  - ✓ Mean age: 67.3 yrs (range: 42-86 yrs)
- Contour augmentation in the esthetic zone at first surgery
- Biopsy taken during a 2nd implant surgery in adjacent site
- Mean time of implants in function:
  - ✓ 44.5 months (range: 14-80 months)
- Histomorphometric analysis to examine the volume percentage of DBBM particles and mineralized bone





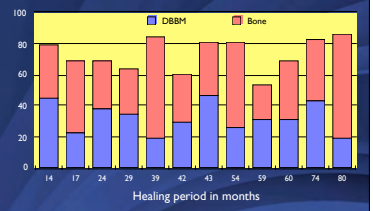
Jensen S, Bosshardt DD, Gruber R, Buser D: Long-term stability of contour augmentation in the esthetic zone. Histologic and histomorphometric evaluation of 12 human biopsies after 14 to 80 months of healing. J Periodontol 85:1549-56, 2014

Results

- Volume percent of mineralized bone
  - ✓ Mean 40.6 % (± 14.6 STD; range 28-67%)
- Volume percent of DBBM particles
  - ✓ Mean 32.0 % (± 9.6; range 19-47%)

Conclusions

- These 12 human biopsies confirm the low-substitution rate of DBBM particles (Bio-Oss)



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TOPICS

- Short introduction
- Treatment options: When immediate, when early, when late?
- Long-term results of early implant placement with contour augmentation
- Conclusions

Conclusions: Esthetic Implant Therapy

- Implant therapy in the esthetic zone is challenging
- The difficulty level is always advanced or complex (Cat. A & C)
- Involved clinicians need to be well educated and experienced
- The clinicians should stick to evidence-based procedures
- Esthetic single tooth replacement is well documented today
- Most of the cases are post-extraction cases
- In these clinical situations, the clinician needs to understand the involved tissue biology

Conclusions: Ridge Alterations post Extraction

- Ridge alteration following tooth extraction is today much better understood
- The resorption of the bundle bone is a biologic phenomenon and cannot be influenced or stopped by surgical or prosthetic means
- In most cases, this resorption must be compensated for with a local contour augmentation to rebuild a facial bone wall of sufficient thickness and height
- This bone structure is important for the soft tissue support and the esthetic outcome on the facial aspect

Treatment Options in post-extraction Sites

- Today, the clinician has a variety of treatment options in post-extraction sites
- Selection of the appropriate timing is crucial
- The clinician should choose a treatment appr[illegible] which offers ...
  - a high predictability for a successful esthetic outcome
  - a low risk for complications
- The treatment of choice depends on the anatomic risk factors and the skills and talent of the clinician

Immediate Implant Placement (Type I)

- *Immediate Implant Placement* should only be used by master clinicians with great skills and experience, since this technique is a complex procedure
  - Main problems are a facial malposition and facial bone resorption
- It should only be used in well selected cases with ideal anatomic conditions, such a thick wall phenotype (> 1mm) and a thick gingival biotype
- Type 1 placement should be done flapless to offer the patient the least possible morbidity

Early Implant Placement with Soft Tissue Healing

- In sites with a thin or a damaged facial bone wall, early implant placement with soft tissue healing is the treatment of choice
- A prerequisite is a sufficient bone volume in the apical area to achieve good primary stability for the implant
- Contour augmentation is routinely performed using GBR
  - Combination of autogenous bone grafts and DBBM particles
  - Resorbable collagen membrane
- Primary wound closure to protect applied biomaterials
- We use a rather short healing period of 8 weeks in routine
  - Early loading protocol

Late Implant Placement

- Late implant placement with >6 months of post extraction healing, is only used for specific patient or site related reasons
- Socket grafting for ridge preservation is strongly recommended
- Socket grafting will not stop bundle bone resorption, but slow down the overall volume reduction and ridge atrophy
- In esthetic sites, subsequent implant placement will need in most cases a simultaneous GBR procedure to optimize the esthetic outcome
- In conclusion, socket grafting helps avoid ridge augmentation procedures with a staged approach

Immediate Placement	Early Placement with Contour Augmentation	Late Placement following ridge preservation
Inclusion Criteria • Thick wall phenotype with intact wall • Thick soft tissue biotype • No acute infection • Primary implant stability	Inclusion Criteria • Thin or damaged facial bone wall • Correct 3D implant position • Primary implant stability	Inclusion Criteria • When immediate or early placement is not applicable
SAC • Complex procedure	SAC • Advanced procedure	SAC • Advanced procedure
Frequency • Rarely in esthetic sites (5-20%)	Frequency • Most often, it's the treatment of choice (>80%)	Frequency • Very rarely (< 2%)


CCDE Video Library
New Release
Animation Video Early Placement
Buser | Chappuis | Chen
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Handout Request to: info@ccde.ch
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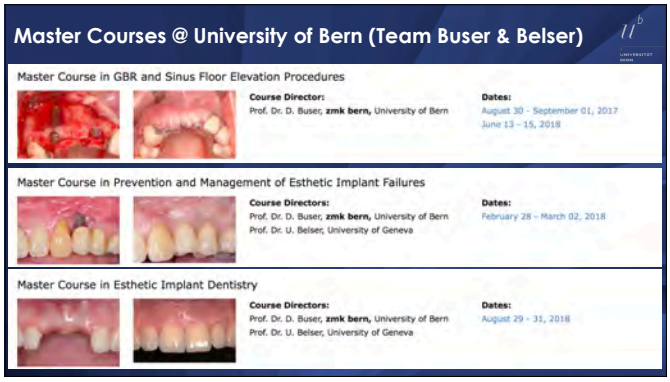
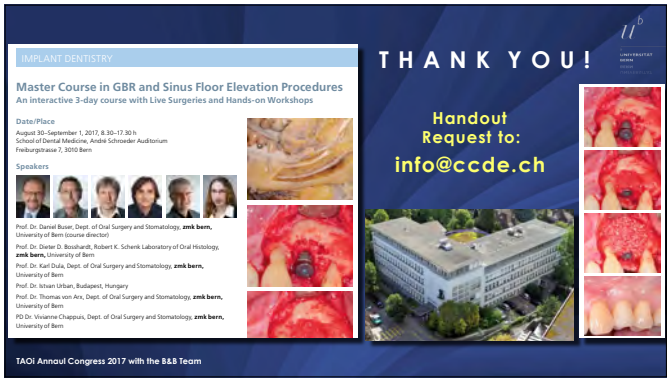

Master Courses @ University of Bern (Team Buser & Belser)
Master Course in GBR and Sinus Floor Elevation Procedures
Course Director:
Prof. Dr. D. Buser, zmk bern, University of Bern
Dates:
August 30 - September 01, 2017
June 13 - 15, 2018
Master Course in Prevention and Management of Esthetic Implant Failures
Course Directors:
Prof. Dr. D. Buser, zmk bern, University of Bern
Prof. Dr. U. Belser, University of Geneva
Dates:
February 28 - March 02, 2018
Master Course in Esthetic Implant Dentistry
Course Directors:
Prof. Dr. D. Buser, zmk bern, University of Bern
Prof. Dr. U. Belser, University of Geneva
Dates:
August 29 - 31, 2018


IMPLANT DENTISTRY
Master Course in GBR and Sinus Floor Elevation Procedures
An interactive 3-day course with Live Surgeries and Hands-on Workshops
Date/Place
August 30–September 1, 2017, 8.30–17.30 h
School of Dental Medicine, André Schroder Auditorium
Freiburgstrasse 7, 3010 Bern
Speakers
Prof. Dr. Daniel Buser, Dept. of Oral Surgery and Stomatology, zmk bern, University of Bern (course director)
Prof. Dr. Dieter D. Bosshardt, Robert K. Schenk Laboratory of Oral Histology, zmk bern, University of Bern
Prof. Dr. Karl Dula, Dept. of Oral Surgery and Stomatology, zmk bern, University of Bern
Prof. Dr. Istvan Urban, Budapest, Hungary
Prof. Dr. Thomas von Arx, Dept. of Oral Surgery and Stomatology, zmk bern, University of Bern
PD Dr. Vivianne Chappuis, Dept. of Oral Surgery and Stomatology, zmk bern, University of Bern
THANK YOU!
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Thank You very much !