State-of-the-art Clinical Procedures in Partially Edentulous Implant Patients – How to achieve excellent long-term Results in Daily Practice

Prof. Buser & Belser
School of Dental Medicine
University of Bern, Switzerland

Greetings from Bern, the Capital of Switzerland

Bernese Alps
Matterhorn/Zermatt

My Clinical Background

• I am a trained Swiss Oral Surgeon
  ✓ Single degree Oral Surgeon, 3-year specialty program for dentists
• Swiss Oral Surgeons are surgical specialists somewhere between an OMFS and a Periodontist
  ✓ They think in smaller flap dimensions and fine surgical techniques
  ✓ They are used to collaborate with restorative dentists and periodontists
• Our department treats 550+ implant patients per year
  ✓ 750 to 800 implants are placed, mostly in partially edentulous patients
  ✓ I personally treat about 150 patients per year
  ✓ My personal experience is now 30+ years with more than 5’000 patients
  ✓ I always work in a Team Approach with a Prosthodontist or a GP
Topics

- All surgical and prosthetic aspects of implant therapy in partially edentulous patients
- How we work in a team
- No discussion on fully edentulous patients

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. sinus lift 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

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 procedures
- 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

Implant Dentistry Today

- Today, we are in a phase of routine application of implant therapy
- In our department, we treat more than 550 patients per year with roughly 750 to 800 implants per year
- More than 90% of our patients are partially edentulous
- The single tooth replacement is the no. 1 indication (> 50%)
- Average of 1.40 implants per patient
- Most patients belong to the baby boomer generation
- The average age of our patients is roughly 63 years
- Many patients have a compromised dentition or anatomy
- Less than 10% of our patients has age <30 (most trauma patients)
- When providing implant therapy, it’s a must to offer successful long-term outcomes
- We always aim at a long-term success of 30+ years

Patients of age > 60 are often compromised and have one or several risk factors

- Medical risk factors
- Dental risk factors
- Anatomic risk factors
- Smoking, however, is not so frequent in this age group
Implant Patient Pool @ Dept. of Oral Surgery/University of Bern

Change in Age Distribution

Mean Age > 60 yrs

2002-2016

0 10 20 30 40
<30 31-40 41-50 61-70 71-80

Implants for elderly patients

MARTH SCHIMMEL, FRANK MÜLLER, VALERIE SUTER & DANIEL BOBER

The “baby boomer” generation refers to people born in years with high fertility, a phenomenon that often occurs after natural disasters or wars. In the 20th century in Europe, the highest baby boom occurred after World War II. In Switzerland, the baby boom period lasted longer than in European countries. The Ger- man baby boom began along with the Vögelinschwestern of the 1950s. In post-war Switzerland, two main waves of baby boomer occurred: one in 1944 and the other in 1963. These children born between 20% of implant patients were over 75 years of age, and amongst these 504 patients, the most frequent indications were dental edentulous situations (19%) followed by single-rooted gum (45%) and esthetic situations (16%). Implantations patients accounted for only 10% of this patients cohort. Today, 60% of patients are in the predominant age group of the post-WWII generation. In this generation, patients are younger and more active. However, the fabric has changed: they have high expectations for their teeth and quality of life. They have low tolerance for their teeth and quality of life.

Implant Indications

- Today, more than 90% of our implant patients are partially edentulous

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Implant Locations

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Implant Locations

Posterior Maxilla: 879 impl = 38.9%

Posterior Mandible: 612 impl = 27.1%

Total = 2'281

Bornstein et al. 2008; Engel-Brugger et al. 2015; Ducommun et al. (in manuscript)
Implant therapy is highly predictable if:

- Indications are carefully chosen using evidence-based criteria
- Well-documented surgical and prosthetic protocols are followed
- The patients are kept in a maintenance care program
- The patients have a good hygiene and do not smoke too much (≤5  cig/day)

There are several 10-year studies available today performed under these conditions showing excellent success and survival rates:

- Studies with modern implant surfaces such as SLA, Osseotite, TiOblast
- The majority of studies showed 10-year success rates >95%
- The benchmarks at the University of Bern are even slightly higher: Implant survival and success rates are >95% at 10 Yrs
- The early failure rate during healing is roughly 1%
- The 10-year success rate is today at 98%

Factors influencing the long-term stability of dental implants:

- The patients have a good hygiene and do not smoke too much
- The patients are kept in a maintenance care program
- Well-documented surgical and prosthetic protocols are followed
- Indications are carefully chosen using evidence-based criteria
- Treatments are modified to improve the attractiveness of implant therapy
- No copy-cat biomaterials
- No cowboy techniques
- Successful outcomes with high predictability
- Low risk for complications
- Least number of surgical interventions
- Reduction of morbidity/pain for patients
- Reduction of healing periods and treatment time
- Less number of surgical procedures
- Esthetic outcomes with high predictability
- Low risk for complications
- Least number of surgical interventions
- Reduction of morbidity/pain for patients
- Reduction of healing periods and treatment time
- Treatment with good cost-effectiveness

Primary Objectives:

- 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

Secondary Objectives:

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

TOPICS – Day 1

- Factors influencing the long-term stability of dental implants:
  - Surgical procedures in isolation and in combination with or without flap elevation
  - Implant placement and restoration techniques:
    - Osteotome techniques
    - Flap elevation
    - Prosthetic planning and restoration techniques in posterior sites
    - Fundamental esthetic principles of implant therapy
    - Esthetic risk assessment and basic surgical principles in aesthetic sites
    - Prosthetic handling of esthetic challenges in aesthetic sites

3 Surgical Strategies for Long-term Success with Implants

- Our treatment concepts are strictly evidence-based and conservative:
  - Primary Objectives:
    - Successful outcomes with high predictability
    - Low risk for complications
  - No cowboy techniques
  - In routine application, we only use biomaterials with a good scientific documentation based on preclinical and clinical studies
  - No copy-cat biomaterials
  - In the past 15 years, our treatment concepts have been carefully modified to improve the attractiveness of implant therapy
  - Secondary Objectives:
    - Least number of surgical procedures
    - Reduction of morbidity/pain for patients
    - Reduction of healing periods and treatment time

Current Objectives of Implant Therapy

- 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
Factors influencing the Long-term Success of Dental Implants

- Implant Surgeon
- Patient
- Surgical Approach
- Bio-materials

Key Elements for Long-term Success of Dental Implants

- Careful pre-operative analysis of a given patient
  - Establish the risk profile of the patient
- Choose the correct surgical approach
  - Understand the tissue biology
  - Choose an appropriate implant with a good scientific documentation
- Insert the implant in the correct 3D position and axis
- Restoration driven implant placement
- Make sure that the implant is fully embedded in bone of sufficient volume
  - In case of a bone deficiency: rebuild the bone with GBR or SFE
- Make sure to have a wide band of keratinized mucosa (KM)
  - KM is lacking: resharpen the implant
  - Try to convert every patient into a «low risk patient»

Basic Principles of Implant Surgery

- Select an appropriate implant type
  - Implant material and surface
- Insert the implant in a correct 3D prosthesis position
- Restoration driven implant placement
- The implant must achieve primary stability
- 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 should be surrounded by healthy and keratinized mucosa

Clinical Studies of the University of Bern in the past 27 Years: Excellent Long-term Results

- Buser et al. 1999
- Buser et al. 2003
- Buser et al. 2008

Our Benchmark for Implant Success Rates

- Low failure rates during healing
  - Daily failure rate during healing around 1%
- High success rates in long-term studies
  - Buser et al. 2012
  - Buser et al. 2014
- These success rates are a strong marketing tool for the acquisition of referrals
  - We have more than 100 referring dentists
  - The fundamental success factor of our business are (a) top treatment quality, and (b) top service quality for the patient and the referring dentist
  - I do a lot of marketing with public lectures (Senior University, Rotary Club, Elitaires Club etc.)
Key Elements for Long-term Success of Dental Implants

- Careful pre-operative analysis of a given patient
  - Establish the risk profile of the patient
  - Choose the correct surgical approach
    - Understand the bone and soft tissue factors
    - Choose an appropriate implant with good bone and soft tissue support
    - Insert the implant in the correct 3D position and axis
    - Address any intra-operative challenges
  - Make sure that the implant is fully integrated in bone of sufficient volume
  - Make sure that the implant is stable in the soft tissues
  - Make sure that the implant is fully incorporated in bone
- Choose an appropriate implant with a good scientific documentation
  - Establish an efficient supportive care program with a dental hygienist
  - Try to convert every patient into a "low risk patient"

Daily Routine in Implant Dentistry

Importance of a careful pre-operative Analysis

- It is important to have a detailed knowledge about the risk factors involved
  - Medical and dental risk factors
  - Smoking
  - Anatomic risk factors, which includes bone and soft tissue deficiencies
  - More than 50% of all implants are placed in sites with a horizontal and/or vertical bone deficiency
  - Implants in post-extraction sites
  - Implants in the posterior maxilla with reduced bone height
  - Implants in healed sites with facial and/or vertical bone atrophy
  - A detailed 3-dimensional (3D) radiographic examination is often required for a proper treatment planning
  - Excellent progress has been made with Cone Beam CT in the past 15 years

Cone Beam Computed Tomography (CBCT)

A revolution of 3D radiologic examination

New Tom
Quantitative Radiology, Italy

I-CAT
Henry Schein, USA

3D Accuitomo
Morita, Japan

Cone Beam Computed Tomography (CBCT)

Major progress in the past 15 years

3D Accuitomo 80
Morita, Japan

3D Accuitomo 170
Morita, Japan
Cone Beam Computed Tomography (CBCT)

- Since 2011: We can choose from 7 different volume sizes
- ALARA principle: As small as possible, as large as necessary
- ALADA principle: Resolution as good as necessary

Key Elements for Long-term Success of Dental Implants

- Careful pre-operative analysis of a given patient
  ✓ Understand the tissue biology
  ✓ Choose an appropriate implant with a good scientific documentation
  ✓ Make sure that the implant is fully embedded in bone of sufficient volume
  ✓ Make sure to have a wide band of keratinized mucosa (KM)
  ✓ Try to convert every patient into a «low risk patient»

- Choose the correct surgical approach
  ✓ Understand the tissue biology
  ✓ Choose an appropriate implant with a good scientific documentation
  ✓ Make sure that the implant is fully embedded in bone of sufficient volume
  ✓ Make sure to have a wide band of keratinized mucosa (KM)
  ✓ Try to convert every patient into a «low risk patient»

- Carry out a proper supportive care program with a dental hygienist
  ✓ Establish an efficient supportive care program with a dental hygienist

The SAC Classification

Classifies the degree of difficulty of an implant case. In doing so it .......
- identifies the skill level required to undertake the treatment
- identifies the risk of complications

- Straight forward (S)
- Advanced (A)
- Complex (C)

SAC Classification

- Straight forward (S)
- Advanced (A)
- Complex (C)
### Selection of Biomaterials in Implant Dentistry

**Criteria for the Selection of Implants**

- Titanium as material of choice for most patients
- Zirconia implants only on demand in less than 1%
- Screw-type implants to provide good primary stability
- Proper implant dimensions based on prosthetic and anatomic considerations
  - Diameter of the implant body and the implant shoulder (platform)
- Modern hydrophilic implant surfaces offer several advantages
  - Our group has a long tradition to successfully use the SLA (since 1997) and the hydrophilic SLActive implant surface (since 2005)
  - Innicell (Thommen Medical) is another hydrophilic implant surface

### Key Elements for Long-term Success of Dental Implants

- Careful pre-operative analysis of a given patient
  - Understand the risk profile of the patient
  - Choose the correct surgical approach
  - Undergo the treatment
- Insert the implant in the correct 3D position and axis
  - Restoration driven implant placement
  - Make sure that the implant is fully embedded in bone of sufficient volume
  - Make sure to have a wide band of keratinized mucosa
  - Establish an efficient supportive care program with a dental hygienist
- Establish an efficient supportive care program with a dental hygienist

### Case Study

- **Patient:** 68-year old patient, no medical risk factors, non-smoker
- **Procedure:** Implant placement with SFE in the left maxilla by a MaxFac surgeon
- **Outcome:** Patient is very unhappy, since she has no occlusal contact
- **Radiographic Analysis:**
  - **Implant 24:** Major bone loss
  - **Implant 26:** Penetrates into the sinus
  - **Implant 25 & 26:** Placed too close, both implants have an axis problem

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Key Elements for Long-term Success of Dental Implants

- Careful pre-operative analysis of a given patient
  - Observe the risk profile of the patient
- Choose the correct surgical approach
  - Understand the anatomy
  - Choose an appropriate implant with a proper anatomical structure
  - Insert the implant in the correct 3D prosthetic position
  - Restoration-driven implant placement

- Make sure that the implant is fully embedded in bone of sufficient volume
  - In case of bone deficiency, rebuild the bone with GBR or SFE
  - Make sure to have a wide band of keratinized mucosa (KM)
  - If KM is lacking, reestablish it with a soft tissue graft
  - Establish an efficient supportive care program with a dental hygienist
  - Try to convert every patient into a "low risk patient"

Basic Principles of Implant Surgery

- Select an appropriate implant type
  - Implant diameter and length
  - Implant shape and surface
- Insert the implant in a correct 3D prosthetic position
  - Restoration-driven implant placement
  - The implant must achieve primary stability

- The implant must be completely embedded in healthy bone
  - Facial and oral bone walls should be at least 1 mm
  - In case of local bone deficiency, GBR

- The implant should be surrounded by healthy and keratinized mucosa
  - Border smooth to micro-rough surface (SLA) is always located subcrestally (>1mm)

The Influence of Bone Thickness on Facial Marginal Bone Response: Stage 1 Placement Through Stage 2 Uncovering

J. Robert Squire,* C. Cory Barch,* Harold F. Martin,** and Sigrids Ochka

* East Carolina University, Healthcare System, Litchfield, NC; ** College of Health Related Professions, University of Arkansas for Medical Sciences, Little Rock, AR; ** Department of Educational Research, University of Nebraska, Omaha, NE

Background: Various causes of facial bone loss around dental implants are reported in the literature. However, reports on the influence of residual facial bone thickness on the facial bone response (host or gain) have not been published. The study measured changes in vertical dimensions of facial bone between consecutive stages of implantation. The study aimed to determine this relationship for maxillary anterior and posterior implants.

Methods: Subjects were consecutively-white ratios, 18 to 60 years of age, with 32 natural teeth. The study included 24 patients, 12 with maxillary anterior implants and 12 with posterior implants. The implants were placed in stage 1 and then uncovered in stage 2. The vertical bone thickness was measured using computed tomography (CT) scans taken immediately before the stage 1 implantation and at the time of stage 2 uncovering. The percentage change in bone thickness was calculated for each patient. The results were analyzed using paired t-tests and correlation analysis.

Results: A significant increase in bone thickness was observed in the maxillary anterior region (p<0.05), while no significant change was found in the posterior region. The mean percentage increase in bone thickness was 18.5% in the anterior region and 0.6% in the posterior region. A strong positive correlation was found between the percentage change in bone thickness and the initial bone thickness (r=0.75, p<0.01).
Key Elements for Long-term Success of Dental Implants

- Careful pre-operative analysis of a given patient
  - Assess the risk profile of the patient
- Choose the correct surgical approach
  - Understand the outcome
- Choose the appropriate implant with a good biological performance
- Insure the implant with the correct type of osteosynthesis
  - Avoid stress on the surrounding structures
- Make sure that the implant is fully embedded in bone of sufficient volume
  - Ensure bone volume is present
- Make sure to have a wide band of keratinized mucosa (KM)
  - If KM is lacking, reestablish it with a soft tissue graft
- Establish an efficient supportive care program with a dental hygienist
  - Try to convert every patient into a «low risk patient»

TAOj Annual Congress 2017 with the B&B Team

Significance of keratinized Mucosa around Implants

- Today, there is consensus that KM is an important prerequisite for long-term success
  - Lin et al. J Periodontal 2013
  - Roccuzzo et al. COIR 2015
- As surgeon, you can always get a band of KM
  - Careful extraction technique
  - Correct healing technique at implant placement or at implant reporting
  - Retract we do soft tissue grafting to widen KM

TAOj Annual Congress 2017 with the B&B Team

Latest publications to peri-implant keratinized Mucosa

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Facial bone thickness (Spray et al. 2000)
Key Elements for Long-term Success of Dental Implants

- Careful pre-operative analysis of a given patient
  ✓ Establish the risk profile of the patient
- Choose the correct surgical approach
  ✓ Confirm the diagnosis
  ✓ Choose an appropriate implant with a good scientific documentation
- Insert the implant in the correct 3D position and axis
  ✓ Restoration driven implant placement
- Make sure that the implant is fully embedded in bone of sufficient volume
  ✓ If there is a bone deficiency, rebuild the bone with GBR or SFE
- Make sure to have a wide band of keratinized mucosa (KM)
  ✓ If KM is lacking, reestablish it with a soft tissue graft
- Establish an efficient supportive care program with a dental hygienist
  ✓ Try to convert every patient into a low risk patient

Long-term success: Compliance with supportive care

Ten year results of a three-arm prospective cohort study on implants in periodontally compromised patients. Part I: Implant loss and radiographic bone loss

Roccuzzo M et al. - Clin Oral Implants Res 2010

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Moderate periodontitis

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Provided by Prof. S

Supportive Care Program and Oral Hygiene

- The dentist must keep the patient in a supportive care program
- The frequency of recall visits depends on the patient’s risk profile
  ✓ Every 6 months in patients with a standard risk profile
  ✓ Every 3 to 4 months in patients with increased risks (heavy smokers, periodontitis, diabetes etc.)
It is important to follow well established surgical and prosthetic protocols to achieve successful outcomes with high predictability. Most often, we can utilize evidence-based methods. Sometimes, we need to follow common sense. For every patient, you need to examine with a careful pre-operative analysis. Establish the risk profile of every patient. Implant therapy is not always the best option in a given situation. Choose an appropriate implant to achieve your goals. The implant system should be well documented. The implant should have a sufficient diameter and length. The implant should have a modern, hydrophilic surface. Insert the implant in a correct 3D position. Follow restoration-driven implant placement. Make sure that implant circumferentially embedded in bone with sufficient volume. The micro-rough implant surface must be inside the bone. The facial bone wall should be >1.5 mm at implant placement. In case of a bone defect, rebuild the bone with GBR or SFE. Choose an appropriate healing modality. Submerged or non-submerged healing. Make sure that implant is located in a sufficient band of keratinized mucosa (KM). Choose an appropriate healing period. Make sure that the implant patient is kept in a sufficient supportive care program. The frequency of recall visits is adapted to the risk profile.