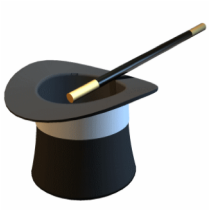
The magic of osseointegration

The 7 GOLDEN RULES

IMPLANTOLOGY YEAR COURSE
Module 1
May 2018

STUART ELLIS BDS MFGDP(UK) DPDS MSc
Course Director
Cavendish House Implant Centre
Cambridge



Aims & Objectives

- What is 'osseointegration'
- Achieving stable osseointegration
- Avoiding the pitfalls - 'The 7 Rules'

What is osseointegration?

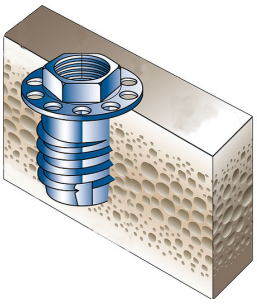
Definition (Bränemark):

A direct structural and functional connection between ordered living bone and the surface of a load-carrying implant, at the light microscope level.

What is osseointegration?

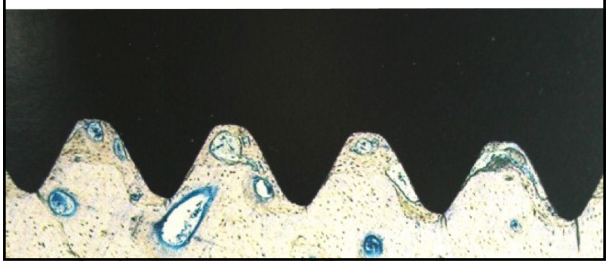
Surface area of contact:

Not all of the implant is in contact with hard tissue



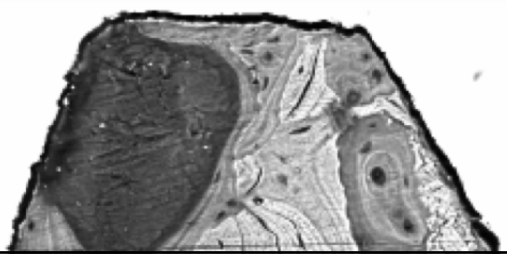
What is osseointegration?

Surface area of contact (light microscope level):
Not all of the implant is in contact with hard tissue

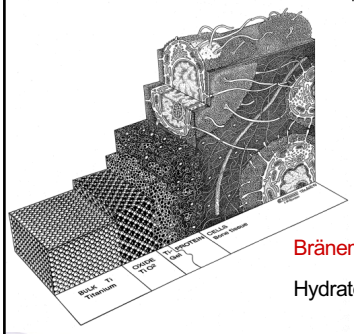


What is osseointegration?

Surface area of contact (high magnification level):
NONE of the implant is in contact with hard tissue



What is osseointegration?



Brånemark (2001)

Hydrated titanium peroxy matrix

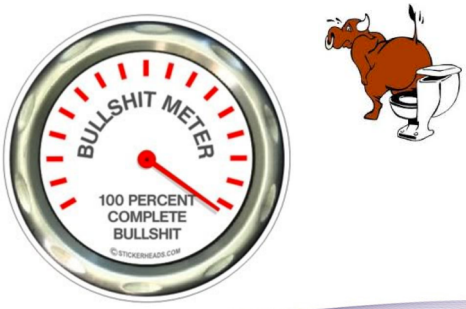
More extensive oxide growth occurs on titanium implants subjected to biological tissues. Inflammatory cells, especially macrophages, may contribute to development of the oxide layer by excreting proteolytic enzymes, cytokines, superoxide, and hydrogen peroxide

What is osseointegration?

What is osseointegration?

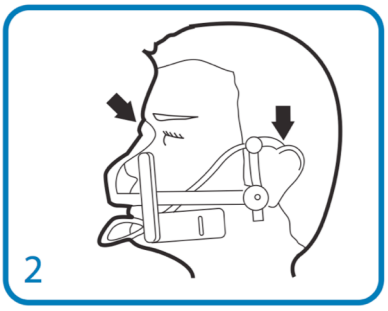
What is osseointegration?

What is osseointegration?

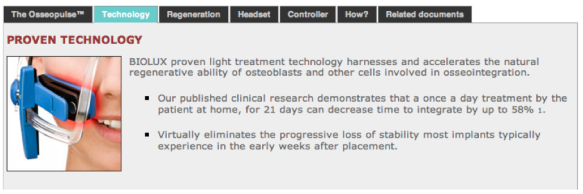


What is osseointegration?

What is osseointegration?



What is osseointegration?



What is osseointegration?

An integrated implant:

The implant is stuck in the bone and it's not coming out!

Dental Implants: Benefit and Risk

National Institute of Health
Consensus Development
Conference Statement
June 13-14, 1978

Criteria for success

To be successful (1978):

- The dental implant should provide functional service for five years in 75% of the cases.
- Should show bone loss no greater than one-third of the vertical height of the implant
- Mobility of less than 1 mm in any direction

Criteria for success

To be successful (current criteria):

- The dental implant should provide functional service.
- Expect 95% survivability at 5 years and 92% at 10 years.
- Should not exhibit progressive bone loss
- Should not be clinically mobile
- Should be surrounded by healthy soft tissues

A) Implant Positioning
B) Implant Design
C) Surgical Protocols
D) Operator Experience
E) Maintenance

19

A cylindrical screw

20

A plank of wood

21

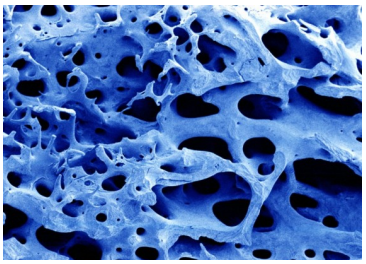
Dental implant screw

22

Bone

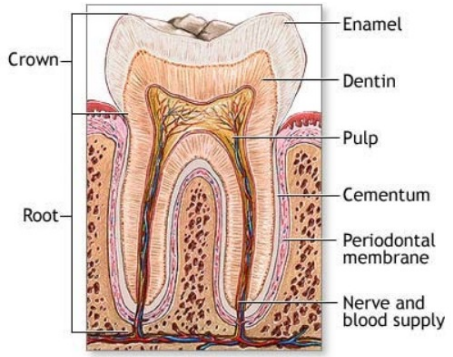
A living tissue:

- Blood Supply
- Constantly changing
- Mechanical stimuli
- Patient's health
- Patient's age



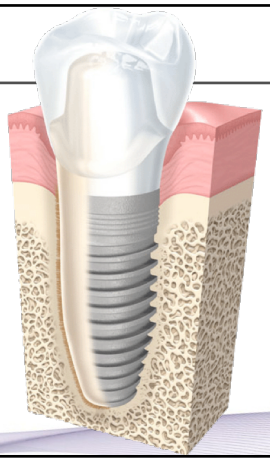
23

A tooth in the bone

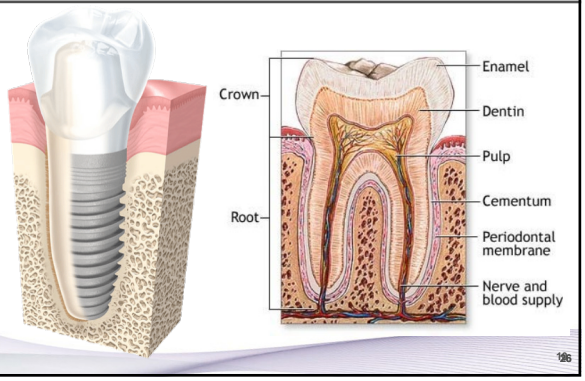


24

An implant in bone



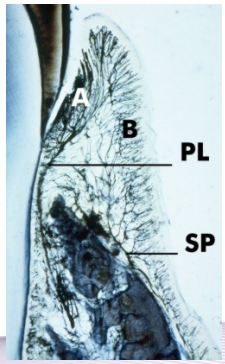
Tooth v Implant



The periodontal ligament

India-ink injected blood vessels in a monkey gingiva

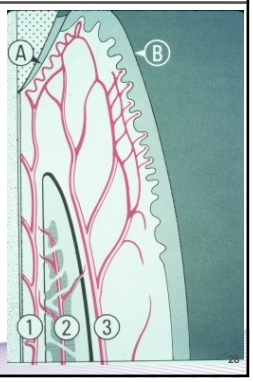
A - vascular plexus adjacent to junctional epithelium
B - vascular plexus adjacent to oral epithelium
PL - vascular supply from periodontal ligament
SP - supraperiosteal blood supply



The periodontal ligament

Blood supply to alveolar bone:

1 - blood supply from periodontal ligament
2 - blood supply from alveolar process
3 - supraperiosteal blood supply



Blood supply to bone around an implant:

WAS (before the extraction):

1 - blood supply from periodontal ligament
2 - blood supply from alveolar process
3 - supraperiosteal blood supply

BECOMES (after the extraction):

1 - GONE
2 - blood supply from alveolar process
3 - supraperiosteal blood supply

Rule number 1:

Problem:

Thin buccal plates may not have enough blood supply after PDL removed, resulting in bone loss.

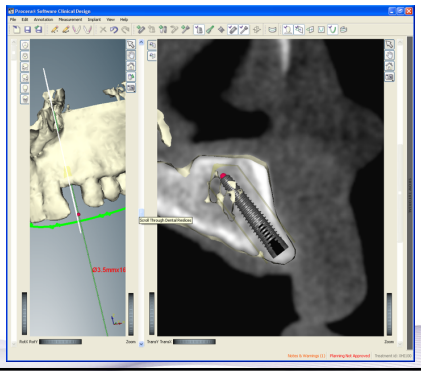
Risk management

Ensure 1.5mm bone around an implant, especially buccal plate of anterior region.

Rule number 1:

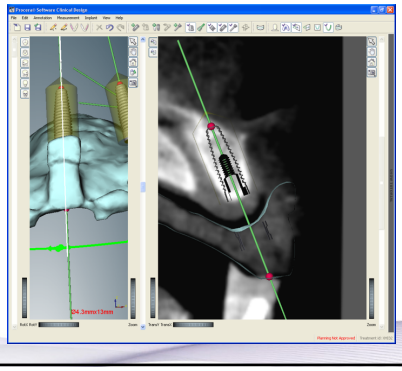
151

Rule number 1:



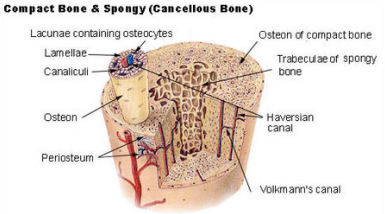
152

Rule number 1:



153

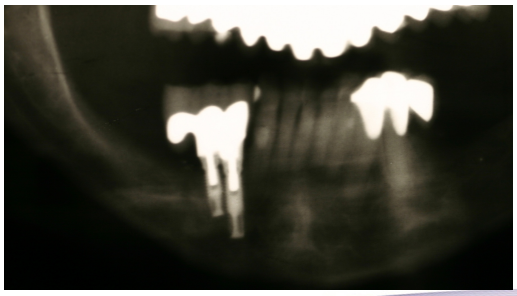
Rule 2 - Implant spacing



Must maintain enough thickness of bone between implants to ensure adequate volume for blood transportation

154

Osseointegration



155

Rule number 2:

Problem:

Bone between implants has compromised blood supply as no PDL either side (as occurs between teeth). Therefore must have sufficient thickness for blood volume transportation

Risk management

Ensure 3.0mm bone between implants

156

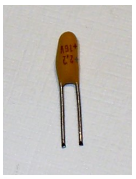
A) Implant Positioning
B) Implant Design
C) Surgical Protocols
D) Operator Experience
E) Maintenance

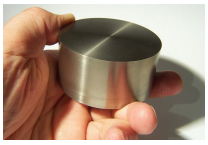
237

Implant Design - material

Materials which osseointegrate:

- Tantalum
- Zirconia
- Titanium

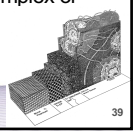




Implant Design - material

Branemark (2001):

Hypothesized that the actual interface of the titanium implant to the living tissue is a hydrated titanium peroxy matrix. The formation of such a matrix is unique to titanium, as the other possible transition metals either have too low solubility of their peroxy complex or too low stability of the complex.



39

Rule number 3:

Problem:

Hundreds of different implant systems on market (>900)

Risk management

Use a well researched, established system with a good track record and high quality controls in manufacture. Use a cylindrical screw design of titanium implant with a **moderately** rough surface.

240

A) Implant Positioning
B) Implant Design
C) Surgical Protocols
D) Operator Experience
E) Maintenance

241

Surgical Protocol

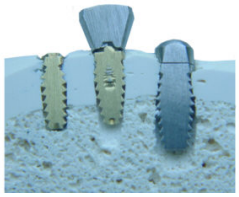
Eriksson et al (1984)

Bone necrosis occurred when:

40˚C applied 7mins
47 ˚C applied 1min

242

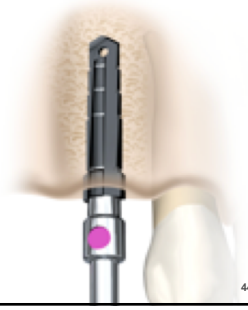
Surgical Protocol



Overheating more likely in D1 (very dense) bone
- more friction

Surgical Protocol

Use sharp burs - internal & external irrigation
- sterile water/saline

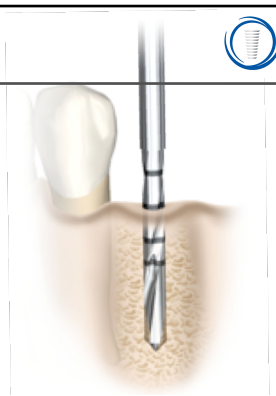


Surgical Protocol

Gradually increase bur diameter
- follow protocol

Surgical Protocol

Use intermittent pressure during drilling
- use a small 'pecking' action
- DO NOT SAW



Rule number 4:

Problem:

Bone necrosis occurs with relatively small temperature increases

Risk management

Use sharp, internally & externally irrigated drills with a sequential increase in drill diameter and an intermittent pressure 'pecking' technique.

Do not apply too much pressure to the drill.

Implant stability (Primary Stability)

Depends upon:

- Density of recipient bone - D1 bone very high primary stability, D4 bone very low
- Size of osteotomy preparation - under-prepare in low density maxillary bone (D4 bone), i.e. RP implant driven into a NP hole.

Implant stability (D4 bone)

Osteotomes

Implant stability (D1 bone)

Screw Tap

Rule number 5:

Problem:

Ensuring good primary stability

Risk management

Under-prepare soft, low density maxillary D4 bone sites

Pre-tap very hard, dense D1 mandibular bone site

A) Implant Positioning
B) Implant Design
C) Surgical Protocols
D) Operator Experience
E) Maintenance

Operator experience

Morris et al (1997), Lambert et al (1997), Preisket, Tsolka (1995):

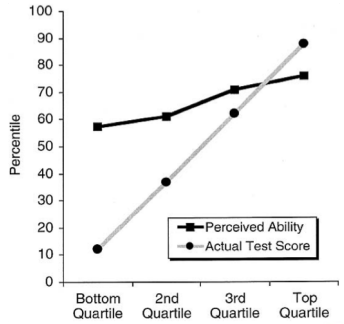
Failure rates almost **twice** as high with inexperienced operators.

Operator experience

Kruger J, Dunning D. Journal of Personality & Social Psychology. 1999:77(6):1121-1134

Unskilled & Unaware of It: How Difficulties in Recognizing One's Own Incompetence Lead to Inflated Self-Assessments.

Operator experience



195

Operator experience

196

Rule number 6:

Problem:

Inexperience is related to treatment failure

Risk management

Learn to walk before you run. Increase your case complexity very gradually. Do not take on complex cases in the early stages of your career in implantology.

197

A) Implant Positioning
B) Implant Design
C) Surgical Protocols
D) Operator Experience
E) Maintenance

258

Long Term Maintenance

REMEMBER:

IMPLANTS ARE NOT FIT & FORGET

159

Long Term Maintenance

REMEMBER:

Osseointegration is a continual process

160

Long Term Maintenance

NOTE:

The peak incidence for 'peri-implantitis'

is ***7 years*** post insertion

Long Term Maintenance

THE PATIENT SHOULD:

- Keep a high level of Oral Hygiene
- Not smoke
- Attend for regular reviews, as advised

Long Term Maintenance

THE DENTIST MUST:

- Explain the need for excellent OH in the TP/consent letter
- Explain the risks of poor OH/smoking
- Explain need for regular review in TP/consent

Long Term Maintenance

WHY REVIEW:

- Ensure OH is to standard
- Offer hygienist/OHI tmt if required
- Check health of mucosa - appearance, BOP, probing depths
- Check bone levels - take a PA every year
- Check occlusion - Tooth Wear

Long Term Maintenance

Review regimen:

- 1-2 weeks post insertion
- 1 month post insertion
- 3 months post insertion
- Pre- impression stage (usually 4-6 months)
- 1 month post fit
- 6 months post fit
- Thereafter every year with periapical radiographs

Rule number 7:

Problem:

Complications can occur **anytime** after implant placement

Risk management

Detail the need for a regular review protocol in the TP/consent letter.

Review after discharge at least once per year.

THE END