Oral rehabilitation on dental implants with a tapered compared to a non-tapered implant design

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Given task:

**Participants/population**
Patients with a restoration supported by one or more dental implants

**Intervention(s), exposure(s)**
Dental implant(s) with a tapered form

**Comparator(s)/control**
Dental implant(s) with a non-tapered form

**Primary outcome(s)**
Complications associated with the surgery and restorative phase
Implant and restoration success and survival, maintenance needs
Patient-reported function, satisfaction, quality of life, and esthetic

**Date of registration in PROSPERO**
25 October 2016

**PROSPERO**
International prospective register of systematic reviews
Systematic review of clinical and patient-reported outcomes following oral rehabilitation on dental implants with a tapered compared to a non-tapered implant design
Asbjorn Jokstad, Jeff Ganeles

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Asbjorn Jokstad, Jeff Ganeles. Systematic review of clinical and patient-reported outcomes following oral rehabilitation on dental implants with a tapered compared to a non-tapered implant design. PROSPERO 2016 CRD42016049007 Available from: http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42016049007
1st problem: when does an implant have a tapered form?
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Body Core is cylindrical
- Equidistant

Body Core is Tapered
- Decrease apically
- Equidistant
- Increase apically

(dotted lines are added for visual aid):

Variations of tapering and examples

- Straumann Bone Level Tapered (BLT)
- Bränemark Tapered Effect (TE)
- Osseospeed
- Astra
- NobelActive
- Straumann BLX

"Expanded platform" e.g. Alpha -Bio SFB

"Reverse conical neck" e.g. Alpha -Bio SFB

Osteofix

Tatum D ("Fin-implant")

MIS Seven
1st problem: when does an implant have a tapered form?

Definition: A tapered implant is recognized as a cylindrical implant where the endosseous part narrows in diameter toward the apex.

This definition encompasses all implants where the taper is located in the cervical, middle or apical parts only, as well as implants that taper continuously from the cervical platform to the apex.
MATERIALS & METHODS

PRISMA Format Systematic Review
## PRISMA Format Systematic Review

### Study inclusion
- Randomized clinical trial (RCT)
- Comparison between a tapered versus non-tapered implant design
- At least 10 treated study participants
- A minimum mean follow-up time of 3 years.
- Full publications in English

### Study exclusion
- Zygomatic or orthodontic implants
- Lack of objective outcome measurements
- Focus on post-restoration interventions of adverse treatment outcomes
- Study participants with extensive loss of tissues

### Sources
- PubMed / Medline
- Cochrane Central Register of Controlled Trials
- Personal bibliographic database
- Grey literature: IADR abstracts & Google Scholar
- Hand search reference lists
- Browsing the most recent issues
- Completed Dec 2017

### Extracted data
- Study characteristics
- Risk of bias
- Summary measures, 3 yrs

#### Primary outcomes:
1. Complications associated with the surgery/phase,
2. Implant and restoration success and survival
3. Maintenance needs
4. Patient-reported function, satisfaction, quality of life, and esthetics

#### Secondary outcomes
1. Peri-implant bone-loss
2. Peri-implant soft tissue indices
RESULTS
Identification

Records identified through database searching (n = 106)

Additional records identified through other sources (n = 121)

Records screened after duplicates removed (n = 136)

PubMed search strategy:

`((jaw, edentulous [Mesh Term]) OR (edentulous) OR (edentulism))` AND `(((dental implantation, endosseous[MeSH Terms]) OR "dental implants"[MeSH Terms]) OR endosseous implant*) OR dental implant*)` AND `taper* OR conical NOT connection*)` AND `Success OR survival OR Function OR esthetic* OR complicat* OR maintenance OR Bone OR patient satisfaction OR quality of life OR treatment outcome[MeSH Terms])`. 
Records identified through database searching (n = 106)  
Records screened after duplicates removed (n = 136)  
Full-text articles assessed for eligibility (n = 29)  
Studies included in qualitative synthesis (n = 3 RCTs, 9 articles)  

Additional records identified through other sources (n = 121)  

Records not included (n = 107):  
- Animal study, not human study (n=11)  
- Taper/conical term in context with implant:abutment interface (“Morse”/”Conical seal / connection”/”locking taper”) or the abutment/conus (n=37)  
- Study not an RCT (n=59)  

Full-text articles excluded (n = 20):  
- Average observation period less than 3 years (n=15)  
- Study not an RCT (n=5)
RCT #1
Parallel
95p. 101i.

1 year data

3 years data
84p. 84i.

Studies included in qualitative synthesis
(n = 3 RCTs, 9 articles)
RCT #1

Parallel
177p. 325i.

RCT #2

Studie included in qualitative synthesis (n = 3 RCTs, 9 articles)
Studies included in qualitative synthesis (n = 3 RCTs, 9 articles)

Three-year post-loading results of a randomised controlled, split-mouth trial comparing implants with different prosthetic interfaces and design in partially posterior edentulous mandibles.
Summarizing the results

• 3 RCTs, including 306 patients with 494 implants → 245 patients with 388 implants at 3 years

• 3 RCTs, judged to be at moderate risk of bias.

• Both tapered and non-tapered implants demonstrate satisfactory performance with respect to crestal bone at 3 years (mean 0.6 mm (SD 0.4))

• No patient-reported outcomes or maintenance needs were reported

• Wide scope of reported outcome criteria

• Report clinically insignificant differences between implant designs at 3 years
DISCUSSION

Confounding variables when interpreting the data in the literature:
Bone volume and quality characteristics
Osteotomy preparation protocol and relative mismatch characteristics
Contributing implant geometry features and implant surface roughness
Effect of other implant design details may confound.

- Flange vs. no flange
- Straight vs. flared vs. widening
- Height
- Polished vs. threads
- Added features
- Surface topography
Threading

- Threads vs. non-threads
- Shape: V- vs. square- vs. reverse buttress- vs. combinations
- Number and size of “lead threads”
- Number and location of grooves, groove forms and groove sizes
- Surface micro-topography
- Thread angle

Effect of other implant design details may confound. 2/3
Apex
- Threaded vs non-threaded
- V-shape vs flat vs curved apex
- Holes, round, oblong
- Apical chamber
- Grooves and groove size
- Flared apex
- Surface topography

Effect of other implant design details may confound.
How can innovative implant designs be characterised in the most clinically meaningful manner?

STRAUMANN BLX
Presented April 20, 2018

Sophisticated “smart designing” of innovative implants enabled by new CNC milling technology

- General form
- Connection
- Flange
- Threads
- Apex

Length & Diameter Taper
- Flange shape
- Thread shape
- Apex shape
- Surface roughness

OR perhaps fractal descriptors macro-micro-level

Tiger or Lion claw size?

Design by: Dr. Ophir Fromovich
Conclusions

1. The evidence basis is currently insufficient to conclude whether tapered implants have any benefits compared to non-tapered dental implants in terms of survival or success rates at 3 years or greater.

2. The limited evidence of long-term clinical outcomes signify that the question of whether tapered dental implants have any merits compared to non-tapered remain uncertain for a range of potential clinical indications.

3. Appropriate professional judgment in clinical decision-making must include a comprehensive diagnosis of the patient’s jawbone quality and quantity and consideration of osteotomy protocol in accordance with the patient’s treatment preferences, where the shape of the dental implant is only one contributory factor.