

ITI Annual Conference 2018



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

Asbjørn Jokstad, Tromsø, Norway

Jeffrey Ganeles, Boca Raton, Florida, USA

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

NHS
National Institute for
Health Research

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

Citation

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 CRD42016049607 Available from:

http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42016049607



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



- General form**
- Straight
 - Tapered
 - Conical
 - Ovoid
 - Trapezoidal
 - Stepped
 - Combinations

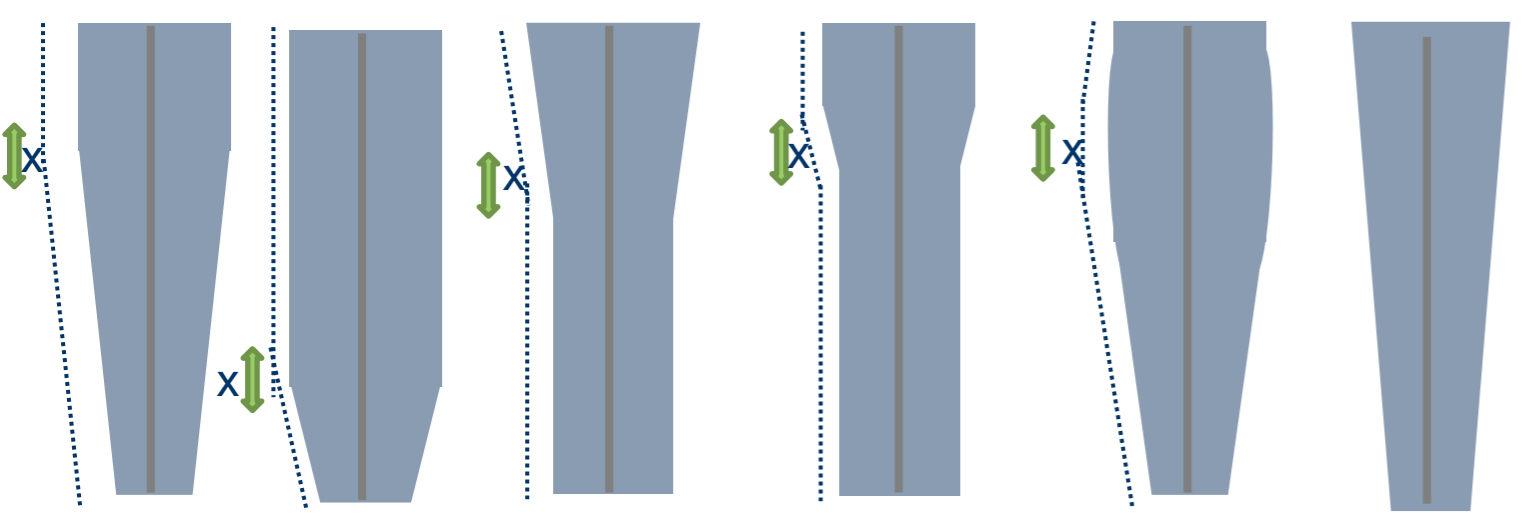




1st problem: when does an implant have a tapered form?



Variations of tapering and examples



Straumann Bone Level Tapered (BLT) Brånemark Mk4 Astra Osseospeed Straumann Tapered Effect (TE) NobelActive Straumann BLX

Body Core is cylindrical

Body Core is Tapered

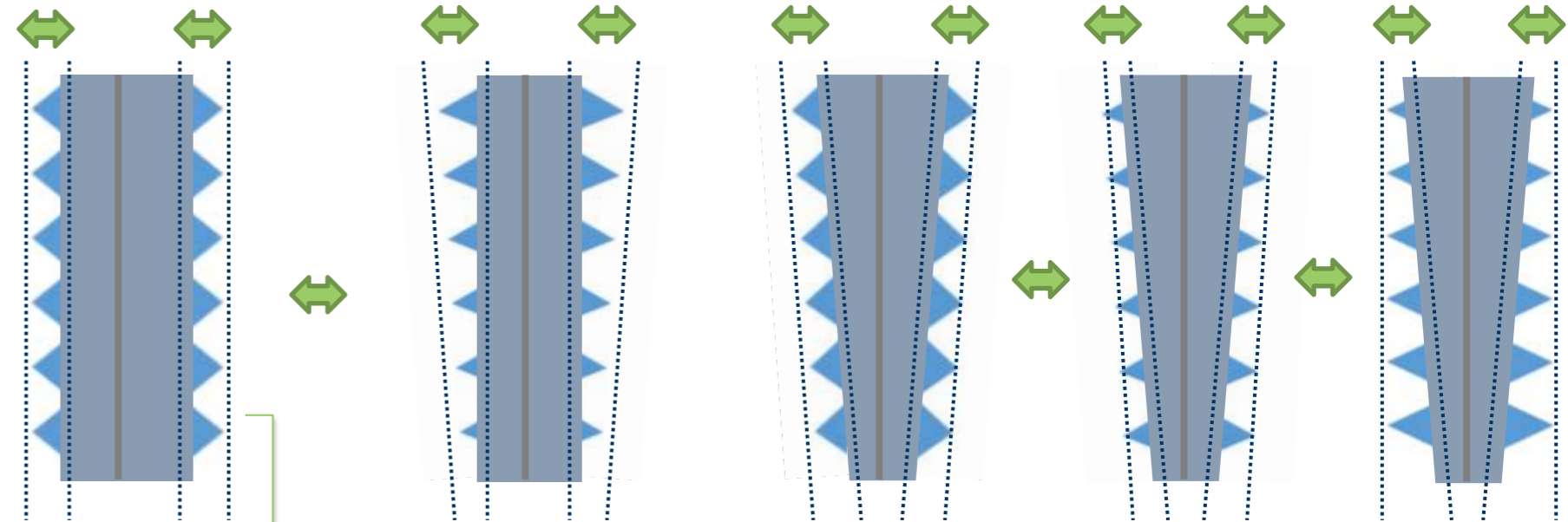
Equidistant

Radius of the threads relative to radius of core

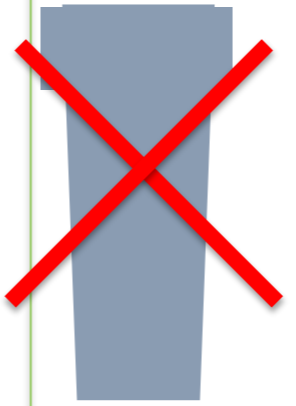
Decrease apically

Equidistant

Increase apically



(dotted lines are added for visual aid):



“Expanded platform”
“Cylindro conical”
“Reverse conical neck”
e.g. Alpha -Bio SFB



Osteofix



Tatum D
("Fin-implant")



MIS Seven

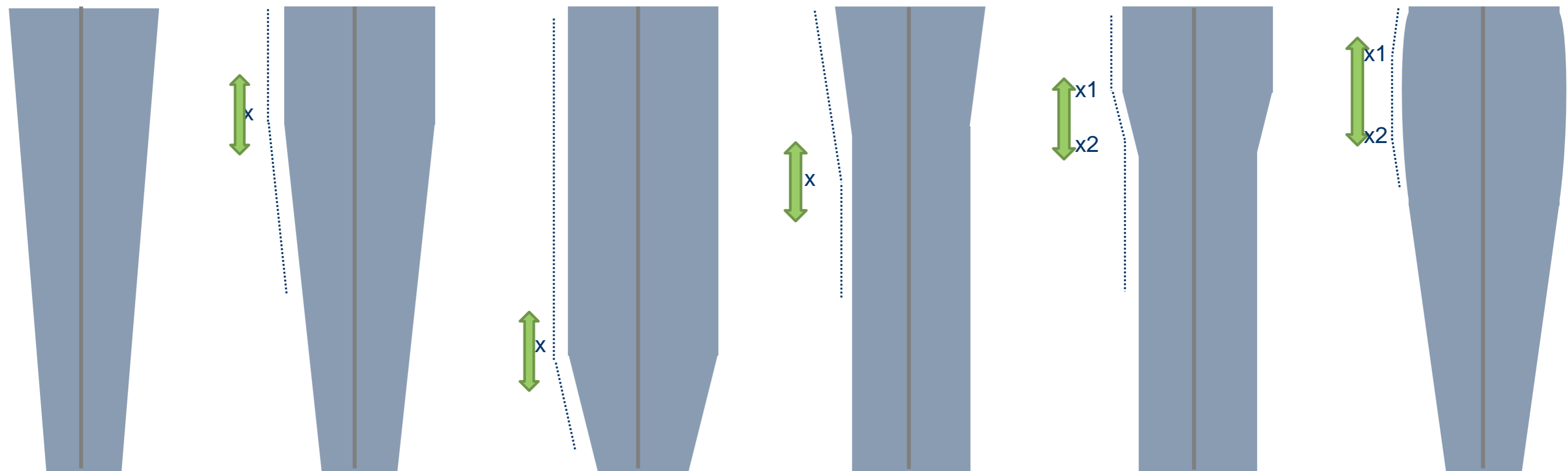


1st problem: when does an implant have a tapered form?



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:

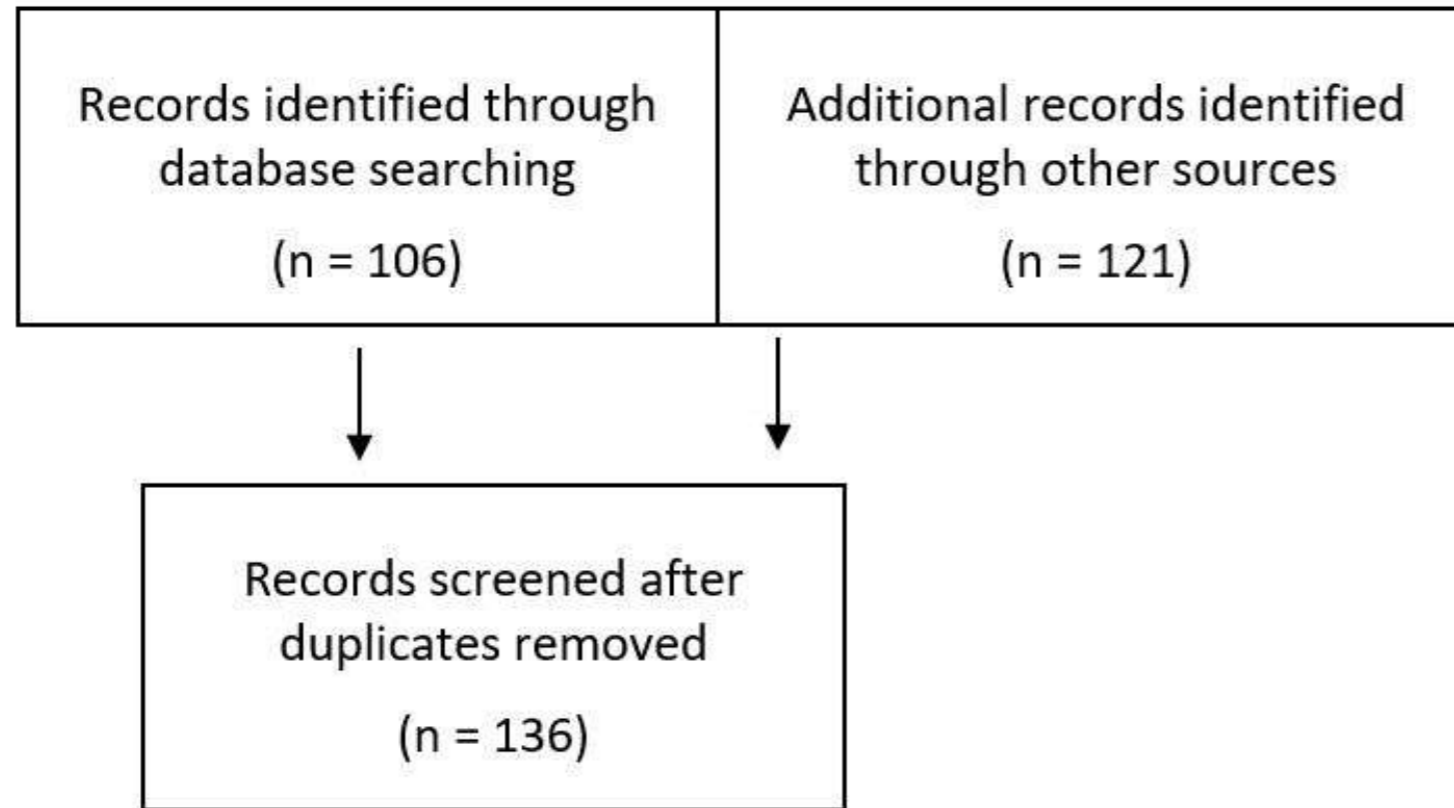
1. complications associated with the surgery/ phase,
2. implant and restoration success and survival
3. maintenance needs
4. patient-reported function, satisfaction, quality of life, and esthetics

Secondary outcomes

1. peri-impl. bone-loss
2. peri-impl. soft tissue indices



RESULTS

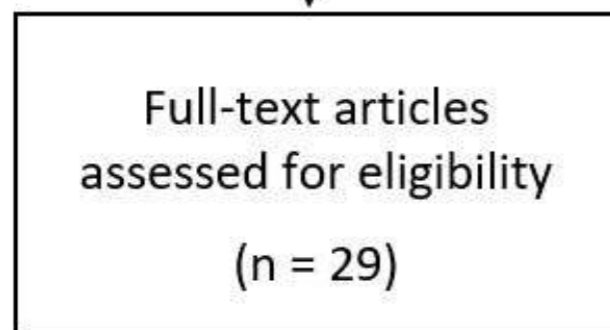
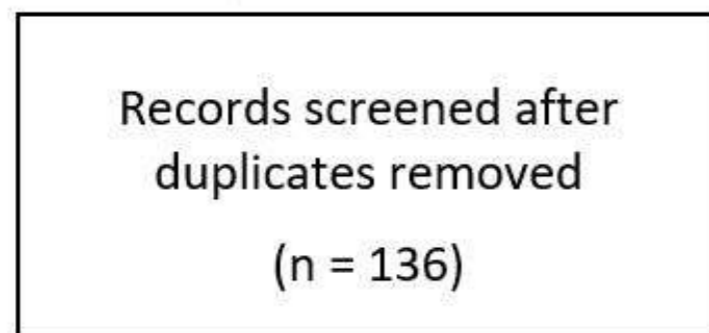
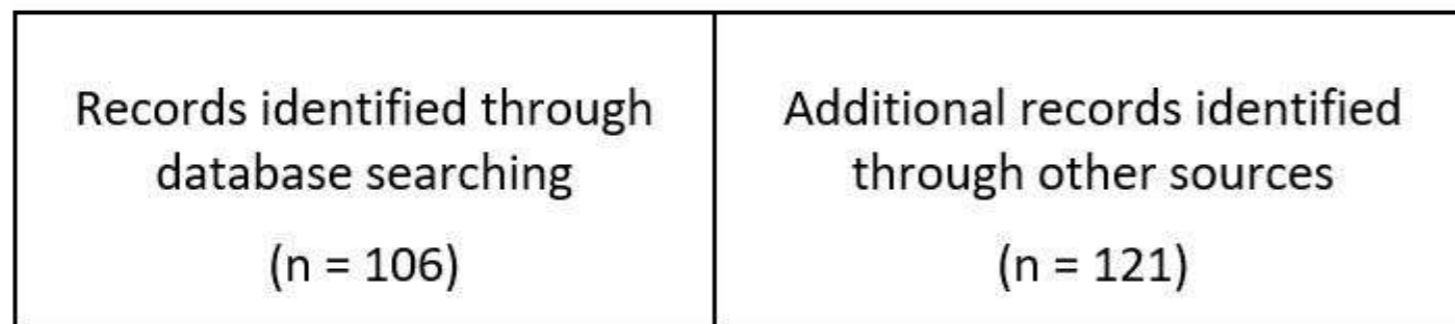


PUBMED SEARCH STRATEGY: ((*jaw, edentulous [Mesh Term]*) OR (*edentulous*) OR (*edentulism*))

*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]*)).*

Identification

Screening

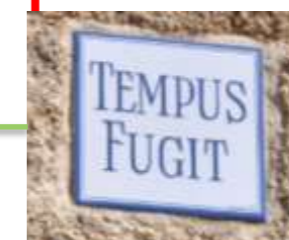


Records not included (n = 107):

- 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)



Identification
Screening
Eligibility
Included

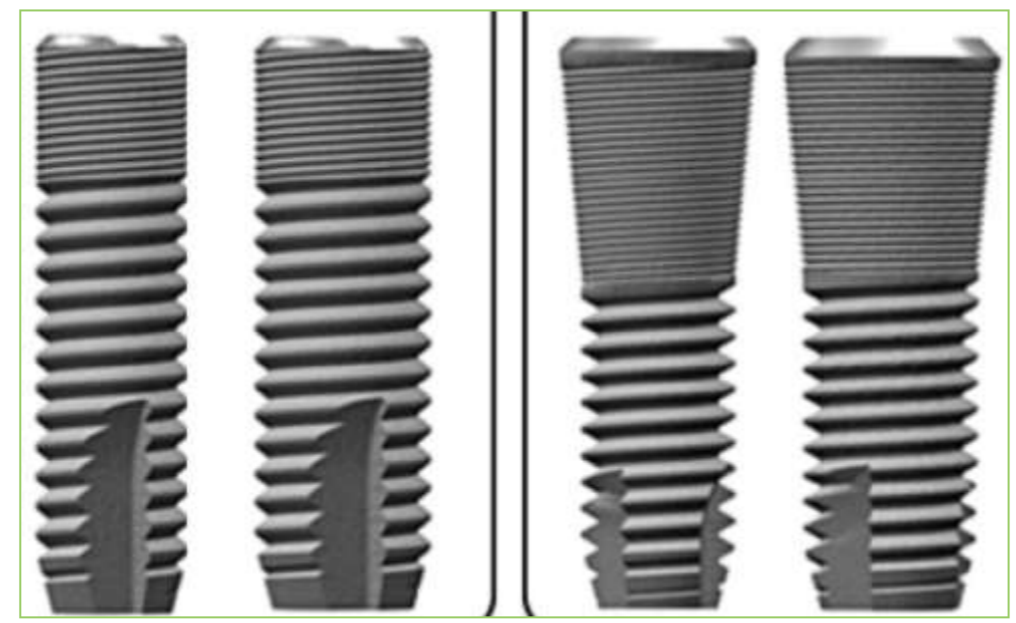
Records identified through database searching (n = 106) | Additional records identified through other sources (n = 121)

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)

**RCT #1
Parallel
95p. 101i.**



1 year data

3 years data
84p. 84i.

CLINICAL ORAL IMPLANTS RESEARCH

Mariano Sanz
Denis Cecchinato
Jorge Ferrus
E. Bjarni Pjetursson
Niklaus P. Lang
Jan Lindhe

A prospective, randomized-controlled clinical trial to evaluate bone preservation using implants with different geometry placed into extraction sockets in the maxilla



CLINICAL ORAL IMPLANTS RESEARCH

Cristiano Tomasi
Mariano Sanz
Denis Cecchinato
Bjarni Pjetursson
Jorge Ferrus
Niklaus P. Lang
Jan Lindhe

Bone dimensional variations at implants placed in fresh extraction sockets: a multilevel multivariate analysis

CLINICAL ORAL IMPLANTS RESEARCH

Guy Huynh-Ba
Bjarni E. Pjetursson
Mariano Sanz
Denis Cecchinato
Jorge Ferrus
Jan Lindhe
Niklaus P. Lang

Analysis of the socket bone wall dimensions in the upper maxilla in relation to immediate implant placement

CLINICAL ORAL IMPLANTS RESEARCH

Jorge Ferrus
Denis Cecchinato
E. Bjarni Pjetursson
Niklaus P. Lang
Mariano Sanz
Jan Lindhe

Factors influencing ridge alterations following immediate implant placement into extraction sockets

CLINICAL ORAL IMPLANTS RESEARCH

Denis Cecchinato
Diego Lops
Giovanni E. Salvi
Mariano Sanz

A prospective, randomized, controlled study using OsseoSpeed™ implants placed in maxillary fresh extraction socket: soft tissues response

CLINICAL ORAL IMPLANTS RESEARCH

Mariano Sanz
Denis Cecchinato
Jorge Ferrus
Giovanni E. Salvi
Christoph Ramseier
Niklaus P. Lang
Jan Lindhe

Implants placed in fresh extraction sockets in the maxilla: clinical and radiographic outcomes from a 3-year follow-up examination

Identification
Screening
Eligibility
Included

Records identified through database searching (n = 106) Additional records identified through other sources (n = 121)

Records screened after duplicates removed (n = 136)

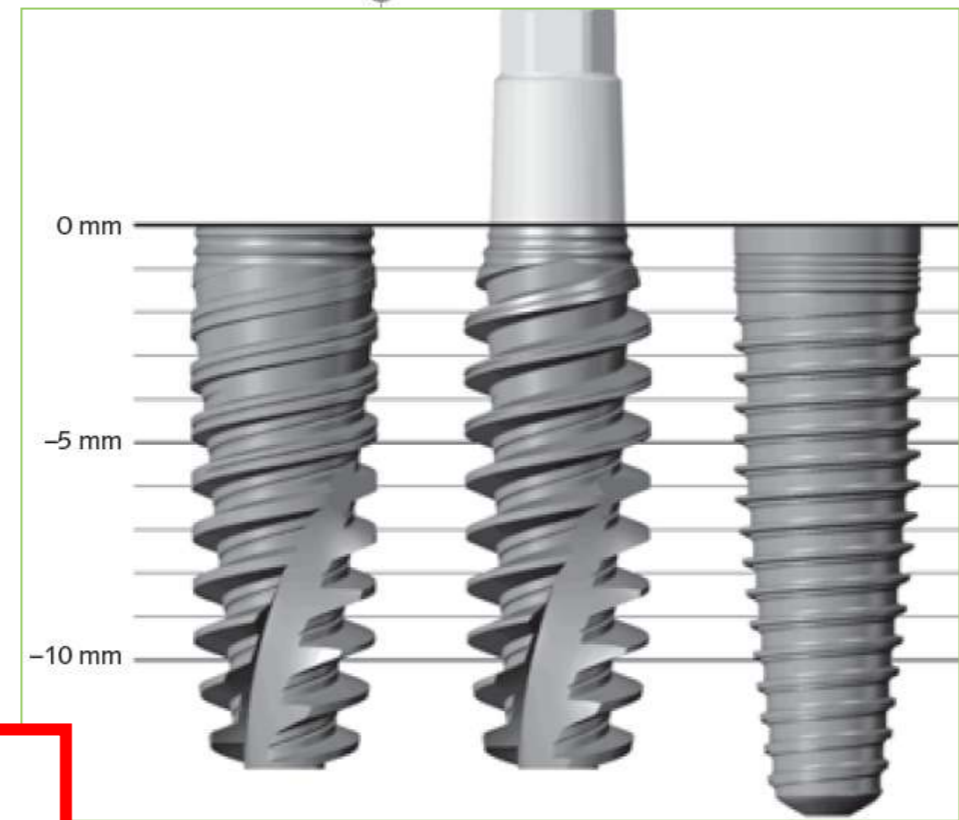
Full-text articles assessed for eligibility (n = 29)

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

<p>CLINICAL ORAL IMPLANTS RESEARCH</p> <p>Gay Hayrab Ba Bianchi E. Pistorusso Mariano Sanz Denis Cocchinato Jorge Ferrus Jan Lindhe Niklaus P. Lang</p> <p>Analysis of the socket bone wall dimensions in the upper maxilla in relation to immediate implant placement</p>	<p>CLINICAL ORAL IMPLANTS RESEARCH</p> <p>Cristiano Tomasi Mariano Sanz Denis Cocchinato Rami Pictursson Jorge Ferrus Niklaus P. Lang Jan Lindhe</p> <p>Bone dimensional variations at implants placed in fresh extraction sockets: a multilevel multivariate analysis</p>	<p>CLINICAL ORAL IMPLANTS RESEARCH</p> <p>Jorge Ferrus Denis Cocchinato E. Bianchi Pistorusso Niklaus P. Lang Mariano Sanz Jan Lindhe</p> <p>Factors influencing ridge alterations following immediate implant placement into extraction sockets</p>	<p>CLINICAL ORAL IMPLANTS RESEARCH</p> <p>Mariano Sanz Denis Cocchinato Jorge Ferrus E. Bianchi Pistorusso Niklaus P. Lang Jan Lindhe</p> <p>A prospective, randomized-controlled clinical trial to evaluate bone preservation using implants with different geometry placed into extraction sockets in the maxilla</p>
<p>CLINICAL ORAL IMPLANTS RESEARCH</p> <p>Mariano Sanz Denis Cocchinato Jorge Ferrus Giovanni E. Salvi Christoph Ramseier Niklaus P. Lang Jan Lindhe</p> <p>Implants placed in fresh extraction sockets in the maxilla: clinical and radiographic outcomes from a 3-year follow-up examination</p>		<p>CLINICAL ORAL IMPLANTS RESEARCH</p> <p>Denis Cocchinato Diego Lago Giovanni E. Salvi Mariano Sanz</p> <p>A prospective, randomized, controlled study using OsseoSpeed™ implants placed in maxillary fresh extraction socket: soft tissues response</p>	

RCT #1

RCT #2
Parallel
177p. 325i.



RANDOMIZED CONTROLLED TRIAL COMPARING A VARIABLE-THREAD NOVEL TAPERED AND A STANDARD TAPERED IMPLANT: INTERIM ONE-YEAR RESULTS

Andrej M. Kielbassa, DDS, PhD,^a Rafael Martinez-de Fuentes, DDS, PhD,^b Moshe Goldstein, DMD,^c Christoph Arnhart, DMD,^d Alberto Barlattani, DDS,^e Jochen Jackowski, DDS,^f Marko Knauf, DDS,^g Martin Lorenzoni, DDS,^h Carlo Maiorana, MD,ⁱ Regina Mericske-Stern, DDS,^j Eric Rompen, DDS, PhD,^k and Mariano Sanz, MD, PhD^l

Charité - Universitätsmedizin Berlin, Berlin, Germany; University of Seville, Seville, Spain; Hadassah Medical Center, The Hebrew University, Jerusalem, Israel; Medical University of Vienna, Vienna, Austria; University Tor Vergata, Rome, Italy; University Witten/Herdecke, Witten, Germany; University of Freiburg, Freiburg, Germany; Medical University of Graz, Graz, Austria; University of Milano, Milano, Italy; University of Bern, Bern, Switzerland; University of Liège, Liège, Belgium; Universidad Complutense de Madrid, Madrid, Spain

1 year

RANDOMISED CONTROLLED CLINICAL TRIAL 123

Copyright by Quintessence

Not for Publication

Christoph Arnhart, DDS
Senior Staff, Oral Surgery, Bernhard Gottlieb Dental School, Medical University of Vienna, Vienna, Austria

Christoph Arnhart, DDS

Comparison of variable-thread tapered implant designs to a standard tapered implant design after immediate loading. A 3-year multicentre randomised controlled trial

3 years data
127p. 236i.

Identification
Screening
Eligibility
Included

Records identified through database searching (n = 106) Additional records identified through other sources (n = 121)

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)

CLINICAL ORAL IMPLANTS RESEARCH
Gay Hayash Ba, Brian E. Pitarsson, Mariano Sanz, Denis Cecchinato, Jorge Ferron, Jan Lindhe, Niklaus P. Lang
Analysis of the socket bone wall dimensions in the upper maxilla in relation to immediate implant placement

CLINICAL ORAL IMPLANTS RESEARCH
Cristiano Tomasi, Mariano Sanz, Denis Cecchinato, Brian Pitarsson, Jorge Ferron, Niklaus P. Lang, Jan Lindhe
Bone dimensional variations at implants placed in fresh extraction sockets: a multilevel multivariate analysis

CLINICAL ORAL IMPLANTS RESEARCH
Jorge Ferron, Denis Cecchinato, E. Brian Pitarsson, Niklaus P. Lang, Mariano Sanz, Jan Lindhe
Factors influencing ridge alterations following immediate implant placement into extraction sockets

CLINICAL ORAL IMPLANTS RESEARCH
Mariano Sanz, Denis Cecchinato, Jorge Ferron, E. Brian Pitarsson, Niklaus P. Lang, Jan Lindhe
A prospective, randomized-controlled clinical trial to evaluate bone preservation using implants with different geometry placed into extraction sockets in the maxilla

RCT #1

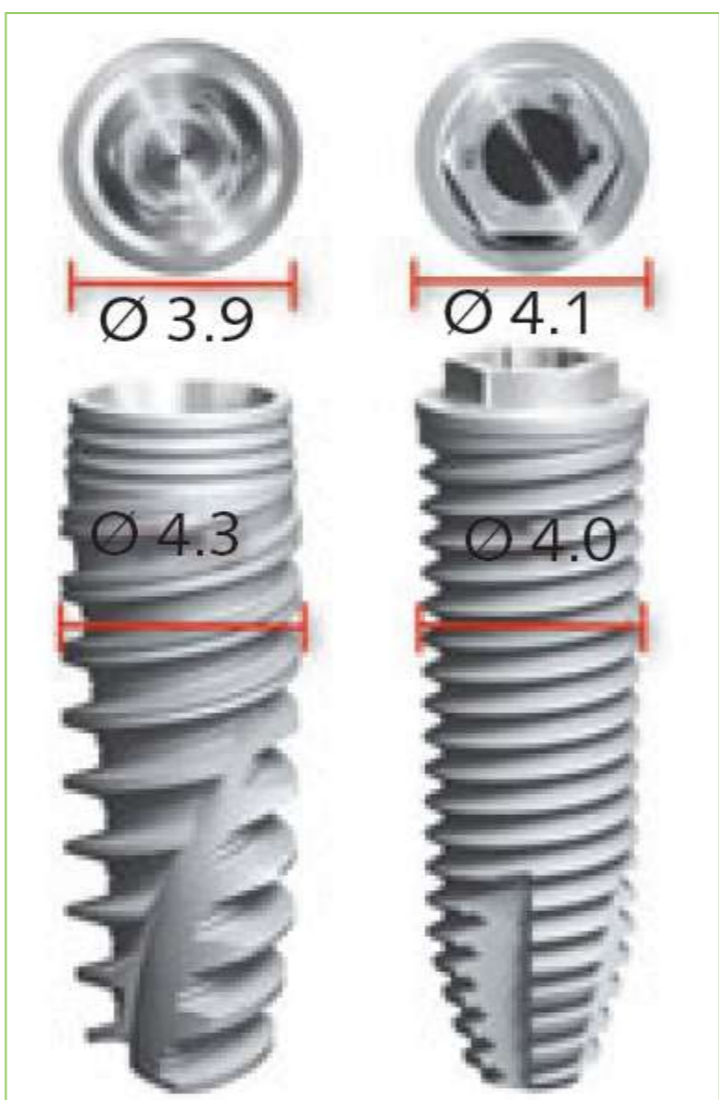
CLINICAL ORAL IMPLANTS RESEARCH
Mariano Sanz, Denis Cecchinato, Jorge Ferron, Giovanni E. Salvi, Christoph Ramseier, Niklaus P. Lang, Jan Lindhe
Implants placed in fresh extraction sockets in the maxilla: clinical and radiographic outcomes from a 3-year follow-up examination

CLINICAL ORAL IMPLANTS RESEARCH
Denis Cecchinato, Diego Lops, Giovanni E. Salvi, Mariano Sanz
A prospective, randomized, controlled study using OsseoSpeed™ implants placed in maxillary fresh extraction socket: soft tissues response

RCT #2

RANDOMIZED CONTROLLED TRIAL
COMPARING A VARIABLE-THREAD NOVEL TAPERED AND A STANDARD TAPERED IMPLANT: INTERIM ONE-YEAR RESULTS
Andrej M. Kielbassa, DDS, PhD, Rafael Martinez-de Fuentes, DDS, PhD, Moshe Goldstein, DMD, Christoph Arnhart, DMD, Alberto Barlattani, DDS, Jochen Jackowski, DDS, Marko Knauf, DDS, Martin Lorenzoni, DDS, Carlo Maiorana, MD, Regina Mericske-Stern, DDS, Eric Rompen, DDS, PhD, and Mariano Sanz, MD, PhD
Charité - Universitätsmedizin Berlin, Berlin, Germany; University of Seville, Seville, Spain; Hadassah Medical Center, The Hebrew University, Jerusalem, Israel; Medical University of Vienna, Vienna, Austria; University Tor Vergata, Rome, Italy; University Witten/Herdecke, Witten, Germany; University of Freiburg, Freiburg, Germany; Medical University of Graz, Graz, Austria; University of Milano, Milano, Italy; University of Bern, Bern, Switzerland; University of Liège, Liège, Belgium; Universidad Complutense de Madrid, Madrid, Spain

RANDOMISED CONTROLLED CLINICAL TRIAL
Comparison of variable-thread tapered implant designs to a standard tapered implant design after immediate loading. A 3-year multicentre randomised controlled trial
Christoph Arnhart, DDS, Senior Staff, Oral Surgery, Bernhard Göttsch Dental School, Medical University of Vienna, Vienna, Austria

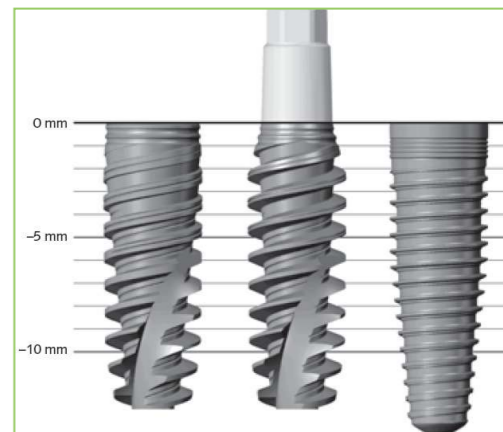
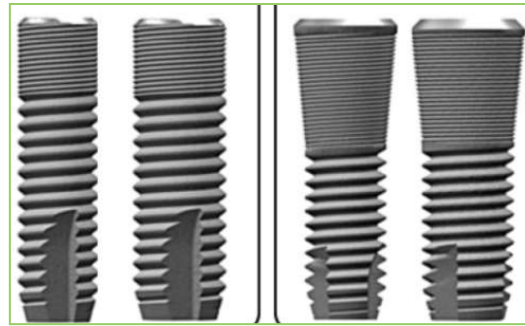


RCT #3 – Split - 34p. 68i.

RANDOMISED CONTROLLED CLINICAL TRIAL
Alessandro Pozzi, Marco Tallarico, Peter K. Moy
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
Alessandro Pozzi, DDS, Researcher, Department of Oral Rehabilitation, Tor Vergata, University of Rome, Italy
Key words: bone level, bone loss, dental implants, platform shifting, implant-abutment interface

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. 1/3



General form



Connection



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

Effect of other implant design details may confound. 2/3

ITI



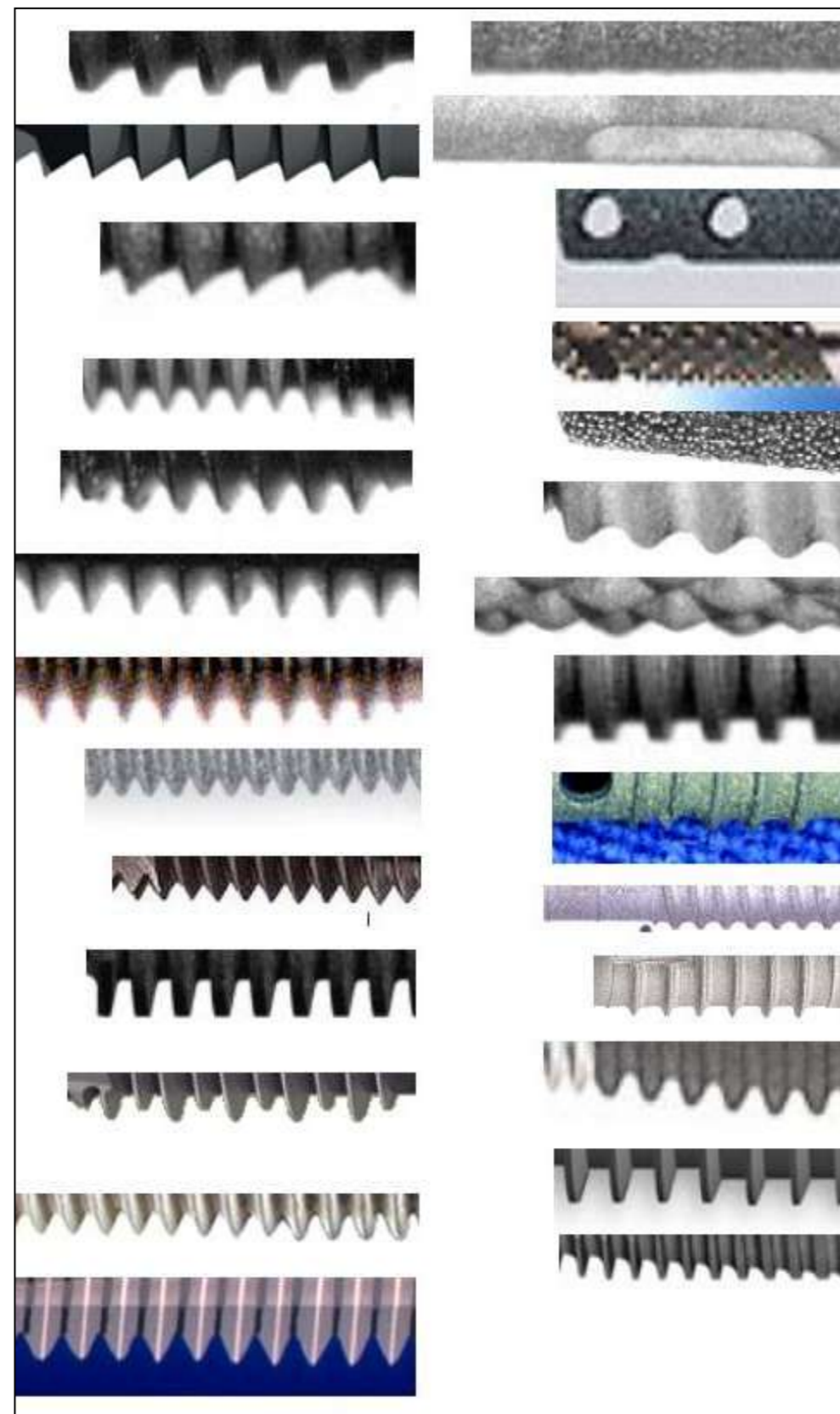
General form



Connection



Flange



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. 3/3

ITI



General form

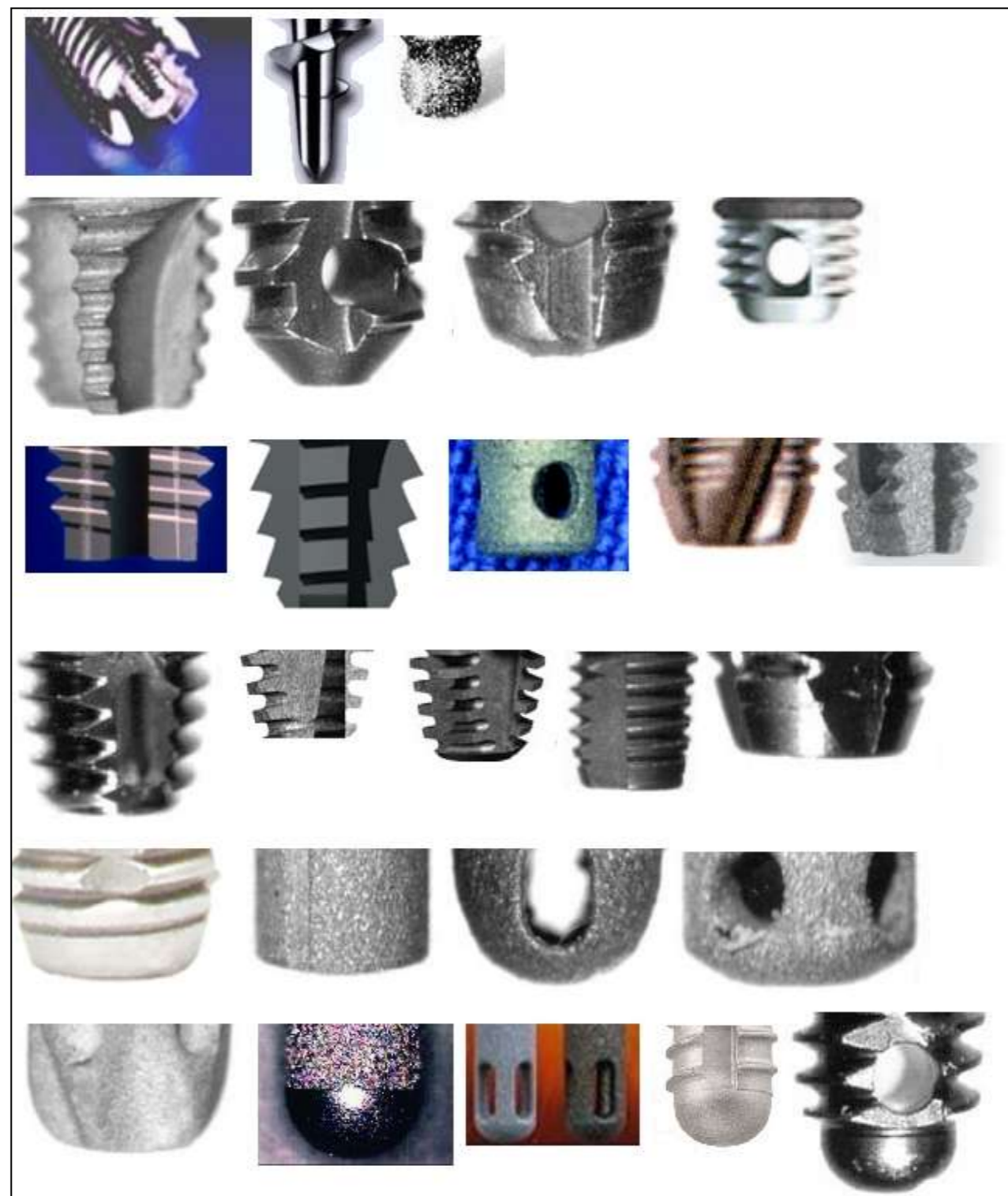


Connection



Flange

Threads



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

How can innovative implant designs be characterised in the most clinically meaningful manner?



General form

STRAUMANN BLX
Presented April 20, 2018

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

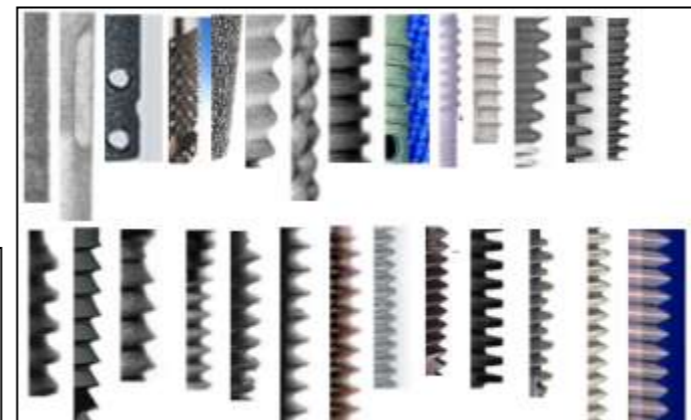


Length & Diameter
Taper
Flange shape
Thread shape
Apex shape
Surface roughness

Tiger or Lion claw size?



Threads



OR perhaps fractal descriptors macro-micro-level

Design by:
Dr. Ophir Fromovich



Connection



Flange



TorcFit™

Apex





Conclusions

1. The evidence basis is currently insufficient to conclude whether tapered implants has 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.