Role of the implant design on immediate loading

Critical appraisal of the evidence from clinical trials

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# Publications reporting data from clinical studies on dental implants (n=4309)

# Publications on clinical studies on dental implants, with focus on effects of implant design factors (n=566)
**Immediate function** - terms

**Patient**

A patient with an edentulous space or jaw desiring immediate restoration of form and function

i.e., immediate loading*

A patient with a terminal tooth or dentition desiring immediate restoration of form and function

i.e., immediate implant (placement + immediate loading)*

*Functional loading: AKA occlusal loading

Nonfunctional loading = (Immediate restoration)

**Immediate function** modalities -

- Immediate implant placement + immediate loading
  - Initial treatment sessions:
    - Placement of implant (healing 1 week)
    - Restoration
  - Restoration (Temporary or permanent)
  - Immediate loading

- Partial socket bone fill
  - Initial treatment sessions:
    - Placement of implant (healing 1 week)
    - Restoration
  - Partial socket bone fill
  - Restoration (Temporary or permanent)
  - Immediate loading

- Fully healed socket
  - Initial treatment sessions:
    - Placement of implant (healing 1 week)
    - Restoration
  - Fully healed socket
  - Restoration (Temporary or permanent)
  - Immediate loading

**# Publications reporting data from clinical studies on dental implants, with focus on immediate loading (n=693 / 4309 reports)**

[Graph showing distribution of studies]
General findings on immediate loading

**Systematic reviews:** 53 (11 in last 2 years)
- Longest clinical research study: 44p/176i over 12 years (range 8-18), retrospective study, ITI-tips anterior mandible (Lambrecht & Holml 2007)

**#RCT trials:** 121 reports (18 in last 2 y.), 76 focus on loading comp., 51 unique RCTs
- First: 10 p. with 40 Nobelbiocare Mk2 i. edent.mand. OD (Chiapasco et al. 2001)
- Largest: 266 p. with 315 Straumann SLA i. for crown/3-4i-FDP (Zöllner et al. 2008)
- Longest: 10 y. 106p/212i/2i-OD (Ma et al. 2010) & 9 y. 44p/121i (Rocci et al. 2011)

121 RCT papers → 76 comparing healing protocols, 51 unique RCTs

![Diagram](image)

Clinical trials with focus on shortened loading protocols according to implant brand

**Prior to 2006 (n=186)**
- Nobel Biocare: 42%
- Straumann (ITI): 18%
- Dentsply: 12%
- Biomet 3i: 7%
- Astra (Dentsply): 9%
- Other manuf.: 22%

**Period 2010-2015 (n=304)**
- Nobel Biocare: 45%
- Straumann (ITI): 10%
- Dentsply: 7%
- Biomet 3i: 7%
- Astra (Dentsply): 9%
- Other manuf.: 37%
Immediate loading vs. healing

(2000-2006)

*discuss possible effects of implant design factors

Glauser et al. (17 reports)
Nkenke & Fenner (38)
Del Fabbro et al. (71)
Ioannidou & Doufexi (Early loading, 13)
Cooper et al. (Edent. Maxilla (9))
Attard & Zarb (93) *
Esposito et al. (RCTs (7))
Misch et al. (24) *
Morton et al. / Chiapasco (Edent. (45)
Ganeles&Wismeijer (Single/Part.Edent. (25))
Romanos (Implant brand A (10)) *
Misch et al. (72) *
Castellon et al. (Mandible anterior (14))
Esposito et al. (RCTs (3))
Lekholm (15) *
Aparicio et al. (45)
Gapski et al. (26) *
Szmukler-Moncler et al. (Vitro & vivo (22))
Ma & Payne (Mand. 2i-OD (25))
Alsabeeha et al. (Mand. OD (10))
Atieh et al. (Postextraction single molars ( 9)) *
Atieh et al. (Single (5))
Atieh et al. (Postextraction single (10)) *
Esposito et al. (RCTs(22))
Gallucci et al. (Edentulous (61))
Roccuzzo et al. (PartialEdent. Post.Max. (8))
Cordaro et al. (Earlyload. PartialEd.Post.Mand. (19))
Grutter & Belser (PartialEdent. Anterior (10))
DeRouck ea (Postextraction single anter. (11))
Henry & Liddelow ("20 best papers")
Sennerby & Gottlow (Publications>2005 (6))
Den Hartog et al. (PartialEdent. Anterior (19))
Esposito et al. (RCTs(11))
Kawai & Taylor (Mand. OD (9))
Avila et al. (28)
Jokstad & Carr (RCT+CCTs (22))

Immediate loading vs. healing

(2007-2010)

*discuss possible effects of implant design factors

Del Fabbro et al. (Postextraction, (50)) *
Sanz-Sanchez et al. (RCTs (29))
Chrcanovic et al. (Occl vs Non-occl. (11))
Benic et al. (Single, RCTs, (11))
Chen & Buser (Postextraction ant. Maxilla (50))
Papaspyridakos et al. (Edent. Fixed. (62))
Schimmel et al. (Edent. Remove., (58))
Schrott et al. (Part. Edent. (24))
Su et al. (RCTs, 26)
Esposito et al. (RCTs (26))
Suarez et al. (6)
Lang et al. (Postextraction, (46))
Menini et al. (All-on-4, (11)) *
Strub et al. (9) *
Enríquez-Sacristán et al. (Postextraction (13))

Immediate loading vs. healing

(2011-2015)

*discuss possible effects of implant design factors

Gualberto et al. (Full mouth) *
Nahhas & Fenner (38)
Del Fabbro et al. (50) *
Cooper et al. (Edent. Mandibula (9))
Esposito et al. (RCTs (3))
Leliont et al. (13)
Avila et al. (28)
Jokstad & Carr (RCT+CCTs (22))
Pre-surgery modifiers
General & local risk factors
Bone quantity and quality (jaw)
Vertical dimension of occlusion
Parafunctional habits

General findings on immediate implants

First clinical research study: Single Tübinger-implants Al2O3 (Schulte 1978)
Longest clinical research study: Retrospective data of 1608 i./981p. over 25y. Nobel Biocare implants (Balshi et al. 2013)

#RCT trials: 51 (9 in last 2 years)
First: 36p./43i, Ti-tps vs Ti_HA +/- DFDB (Gher et al. 1994)
Largest: 208 p./i. Straumann-SLA, after 3 weeks healing (Lang et al. 2007)
Longest follow up: 3 y. 93p/99i Osseospeed (Sanz et al. 2010) & 10 y. 72p/i. Osseotite, placement 10days after extraction (Schropp et al. 2010)

Surgery modifiers?
Flap / Site preparation
Primary stability
Residual infection
Socket defect shape & facial plate integrity/thickness
Facial position of the implant
Soft tissue biotype

Additional modifiers?
Single implant vs. Splinted implants
Occluding vs. Non-occluding
Implant design, including length
General findings, immediate implants with immediate loading

## Systematic reviews: 9 (2 in last 2 years)
161 reports

First clinical research study: 10p./130i, retrop., edent.mand., Brånemark turned i. (Balshi & Wulflinger 1997)

Longest clinical research study: 7 y, retrop., 80p/519i, edentulous jaws, 3i. implants, (Testori et al. 2013)

# RCT trials: 14 (4 in last 2 years)

First: vs.: il (i=dl) 40p. (Crespi ea. 2008)–i. autograft, heal 4 m., il, 76p. (Block ea. 2009)

Largest: vs. Xenograft-membrane, heal 4 m., il, 106p., single max. (Felice et al. 2011)

Longest follow up: 5 years 71p/120i, single posterior, (Prosper et al. 2010)

Surgery Modifiers:
- Flap / Site preparation
- Primary stability
- Residual infection
- Socket defect shape & facial plate integrity/thickness
- Facial position of the implant
- Soft tissue type

Pre-surgery modifiers:
- General & local risk factors
- Bone quantity/quality (jaw)
- Vertical dimension of occlusion
- Parafunctional habits

Additional modifiers:
- Single implant vs. Splinted implants
- Occluding vs. Non-occluding
- Implant design, including length
Effects of implant design factors on outcome (n=566 reports)

- Artzi et al. (2010): Short (8-mm) and narrow (3.3-mm) implant configurations were significantly (P < .05) associated with failure (RCS)
- Zafiropoulos et al. (2009): The type of implant, position, and timing of placement and loading did not influence the survival rate of this treatment method (RCS)
- Li et al. (2009): The implant survival rate was found to be not related to implant diameter, system, configuration, type of abutment connections, and position of implants (P > .05) (RCS)

Immediate implant (n=462 reports)

Immediate loading (n=693 reports)

9 RCTs (13 reports)
- At 2 y: ANKYLOS better than 3i/Certain (Romanos ea 2013)
- At 1 y: Osstem TSIII HA & Zimmer TSV equivalent (Kim ea 2013)
- At 9 y: Bränemark TiUnite better than turned (Rocci ea 2013)
- 3 y: idem. (Fung ea 2011)
- 3 y: idem. (Liddelow&Henry 2010)
- At 1 y: Bränemark TiUnite & turned equivalent (Fröberg ea 2006)
- At 3 y: NobelActive & Replace equivalent (Amhart ea 2012)
- At 10 y: Bränemark, Southern, ITI Ster-Oss equivalent (Ma ea 2010)
- At 3 y: Bränemark M2 & conical equivalent (Gatti&Chiapasco 2002)
Edentulous maxilla, effects of implant design in rehabilitation, studies on immediate loading

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<td>Material</td>
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| Diameter | 
| Degree ea 2005 | 
| Length | 
| vanAssche ea 2012 | 
| Testori ea 2013 | 
| Li ea 2009 | 
| Surface | 
| Material | 

| Length | 
| Kinsel & Liss | 2007 | 
| Artzi ea 2010 | 
| Surface | 
| Material | 

187 titles on immediate loading → 22 papers reporting on 19 RCT/CCT trials

Relative Differences in Survival Estimates

| Reference | 
| Wallin (1991) | 
| Shangaris (2001) | 
| Buchin (2000) | 
| Nitsch (2003) | 
| Reisine (2005) | 
| Dehning (2001) | 
| Vissink (1989) | 
| Carr (2004) | 
| Peker (2002) | 
| Tarnow (2001) | 
| Tarnow (2003) | 
| Colletti (2003) | 
| Carr (2002) | 
| Lekholm (1985) | 
| Tarnow (2002) | 
| van Assche (2001) | 
| Wallin (2002) | 
| Schilf (2001) | 

Timepoint (Months)

-1.0 -0.5 0.0 1.0

Control Better | Immediate Better

Difference in Survival Rates

2% difference →
Relative Differences in Survival Estimates

- 2% lower survival & consistently wider confidence intervals

Implant morphology (smooth, microrough, rough)

- 2% difference in favor of control
Implant morphology (smooth, microrough, rough)

Thank you for your attention

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