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* + *immediate placement* + *immediate loading*.

*«Functional loading» AKA occlusal loading

OR

«Nonfunctional loading» = «immediate function»

**Immediate function** modalities -

**# Publications reporting data from clinical studies on dental implants, with focus on immediate loading (n=693 / 4309 reports)**
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-tps anterior mandible (Lambrecht & Hodel 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 l. edent.mand. OD (Chiapasco et al. 2001)
- Largest: 266 p. with 325 Straumann SLA i. for crown/3-4i-FDP (Zöllner et al. 2008)
- Longest: 10 y. 106p/212i-OD (Ma et al. 2010) & 9 y. 44p/121i (Rocci et al. 2013)

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

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

Prior to 2006 (n=188 )

<table>
<thead>
<tr>
<th>Implant Brand</th>
<th>Number</th>
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<tbody>
<tr>
<td>Nobel Biocare</td>
<td>42%</td>
</tr>
<tr>
<td>Other manuf.</td>
<td>22%</td>
</tr>
<tr>
<td>Biomet 3i</td>
<td>7%</td>
</tr>
<tr>
<td>Dentsply</td>
<td>12%</td>
</tr>
<tr>
<td>Astra (Dentsply)</td>
<td>9%</td>
</tr>
<tr>
<td>Other</td>
<td>21%</td>
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</tbody>
</table>

Period 2010-2015 (n=304)

<table>
<thead>
<tr>
<th>Implant Brand</th>
<th>Number</th>
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</thead>
<tbody>
<tr>
<td>Nobel Biocare</td>
<td>45%</td>
</tr>
<tr>
<td>Astra (Dentsply)</td>
<td>13%</td>
</tr>
<tr>
<td>Biomet 3i</td>
<td>7%</td>
</tr>
<tr>
<td>Dentsply</td>
<td>7%</td>
</tr>
<tr>
<td>Other manuf.</td>
<td>23%</td>
</tr>
<tr>
<td>Other</td>
<td>37%</td>
</tr>
</tbody>
</table>
Immediate loading vs. healing
(SR s 2000-2006)

- Glauser et al. (17 reports) *
- Nkenke & Fenner (36)
- Del Fabbro et al. (71)
- Ioannidou & Doufexi (Early loading, 13)
- Cooper et al. (Edent. Maxilla (9))
- Altard & Zarbi (93) *
- Esposito et al. (RCTs (7))
- Misch et al. (24) *
- Morton et al. (Chapagasso (Edent (45))
- Ganeles&Wismeijer (Single/Part. Edent. (25))
- Lekholm (15) *
- Aparicio et al. (45)
- Gapak et al. (26) *
- Szmukler-Mancier et al. (Vitro & vivo (22))

*discuss possible effects of implant design factors

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Immediate loading vs. healing
(2007-2010)

- Ma & Payne (Mand. 2i-OD (25))
- Alsaabeha et al. (Mand. OD (10))
- Ateh et al. (Postextraction single molars (9)) *
- Ateh et al. (Single (5))
- Ateh et al. (Postextraction single (10)) *
- Esposito et al. (RCTs (22))
- Gallucci et al. (Edentulous (6)) *
- Roccuzzo et al. (Partial/Edent. Post. Max. (9))
- Contaro et al. (Earlyload. Partial/Edent. (19))
- Drubetz & Balseer (Partial/Edent. Anterior (10))
- DelRouck et al (Postextraction single ane. (11))
- Henry & Liddelow (‘20 best papers’)
- Sennerby & Gottlow (Publications>2005 (6))
- Den Hartog et al. (Partial/Edent. Anterior (19))
- Esposito et al. (RCTs (11))
- Kawai & Taylor (Mand. OD (9))
- Avila et al. (28)
- Jokstad & Carr (RCT+CCTs (22))

*discuss possible effects of implant design factors

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Immediate loading vs. healing
(2011-2015)

- 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 anl. Maxilla (50))
- Papaspyridakos et al. (Edent. Fixed. (62))
- Schrott et al. (Partial/Edent. (24))
- Schimmel et al. (Edent. Remova.. (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))

*discuss possible effects of implant design factors
Pre-surgery modifiers

General & local risk factors
Bone quantity and quality (jaw)
Vertical dimension of occlusion
Parafunctional habits

Surgery modifiers?
Flap / site preparation
Primary stability

Additional modifiers?
Single implant vs. Splinted implants
Occluding vs. Non-occluding implants
Implant design, including length

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

Pre-surgery modifiers

General findings on immediate loading

# Systematic reviews: 53 (11 in last 2 years)


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Single implant vs. Splinted implants
Occluding vs. Non-occluding
Implant design, including length

Pre-surgery modifiers

General & local risk factors
Bone quantity and quality (jaw)
Vertical dimension of occlusion
Parafunctional habits

General findings on immediate implants

# Systematic reviews: 22 (11 in last 2 years)

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)

Pre-surgery modifiers

General & local risk factors
Bone quantity and quality (jaw)
Vertical dimension of occlusion
Parafunctional habits

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 implants
Implant design, including length
# Publications reporting data from clinical studies on dental implants, with focus on immediate implants with immediate loading (n=161 / 693 reports)

## General findings, immediate implants with immediate loading

### Systematic reviews:
- 9 (2 in last 2 years)

### First clinical research study:
- 10p./130i., retrosp., edent.mand., Brånemark turned t. (Balshi & Wolfinger 1997)

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

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

#### First:
- vs.: (i+dl) 40p. (Crespi ea. 2008)– (ii+dl) 76p. (Block ea. 2009)

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

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

### Surgery Modifiers:
- Pre-surgery modifiers
  - General & local risk factors
  - Bone quantity/quality (jaw)
  - Vertical dimension of occlusion
  - Parafunctional habits
- Site / Site preparation
  - Primary stability
  - Residual infection
  - Socket defect shape & facial plate integrity/thickness
  - Facial position of the implant
  - Soft tissue type

### 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)

- Immediate implant (n=462 reports)
- Immediate loading (n=693 reports)

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- Effects of implant design factors on outcome (n=566 reports)

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- Immediate loading (n=693 reports)

- Effects of implant design factors on outcome (n=566 reports)
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 (3)Certain (Romanos ea 2013)
- At 1 y: Ostem TSBill HA & Zimmer TSV equivalent (Kim ea 2013)
- At 9 y: Brånemark TiUnite better than turned (Rocci ea 2013)
- 3y: idem. (Fung ea 2011)
- 3y: idem. (Lidlovsk&Wenoo 2010)
- At 1 y: Brånemark TiUnite & turned equivalent (Froberg ea 2000)
- At 3 y: NobelActive & -Replace equivalent (Amhart ea 2012)
- At 10y: Brånemark, Southern, TI Ster-Oss equivalent (Ma ea 2010)
- At 3y: Brånemark MN2 & conical equivalent (Gatti&Chiapasco 2002)
Edentulous maxilla, effects of implant design in rehabilitation, studies on immediate loading

<table>
<thead>
<tr>
<th>Design</th>
<th>Diameter</th>
<th>Length</th>
<th>Surface</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>Degidi &amp; Piatelli 2003</td>
<td>Li 2009</td>
<td>Testori et al. 2013</td>
<td>Malo et al. 2011a</td>
</tr>
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**Summary**

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

**Relative Differences in Survival Estimates**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Timepoint (Months)</th>
<th>2% difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ibanez (2005)</td>
<td>12</td>
<td></td>
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</table>
Relative Differences in Survival Estimates

~2% lower survival & consistently wider confidence intervals

Implant morphology (smooth, microrough, rough)

2% difference in favor of control
Thank you for your attention

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