IMMEDIATE AND EARLY LOADING OF HYDROTHERMALLY TREATED, HYDROXYAPATITE COATED DENTAL IMPLANTS: 6-7 YEAR FOLLOW-UP RESULTS

• AFARIN ARGHAMI, DDS
• LSU SCHOOL OF DENTISTRY
• DEPARTMENT OF PERIODONTICS
DENTAL IMPLANTS

What do we want?
The best, the prettiest, the cheapest

When do we want it?
Right now!!!
## IMPLANT SUCCESS:

<table>
<thead>
<tr>
<th>Implant Quality Scale Group</th>
<th>Clinical Conditions</th>
</tr>
</thead>
</table>
| I. Success (optimum health) | a) No pain or tenderness upon function  
   b) 0 mobility  
   c) ≤2 mm radiographic bone loss from initial surgery  
   d) No exudates history |
| II. Satisfactory survival   | a) No pain on function  
   b) 0 mobility  
   c) 2–4 mm radiographic bone loss  
   d) No exudates history |
| III. Compromised survival  | a) May have sensitivity on function  
   b) No mobility  
   c) Radiographic bone loss >4 mm (less than 1/2 of implant body)  
   d) Probing depth >7 mm  
   e) May have exudates history |
| IV. Failure (clinical or absolute failure) | Any of following:  
   a) Pain on function  
   b) Mobility  
   c) Radiographic bone loss >1/2 length of implant  
   d) Uncontrolled exudate  
   e) No longer in mouth |
FACTORS AFFECTING MARGINAL BONE STABILITY:

- IMPLANT LENGTH AND DIAMETER
- IMPLANT DESIGN
- SURFACE CHARACTERISTICS
- LOADING PROTOCOL
FACTORS AFFECTING MARGINAL BONE STABILITY:

• IMPLANT LENGTH AND DIAMETER
• IMPLANT DESIGN
• SURFACE CHARACTERISTICS
• LOADING PROTOCOL
LOADING OF IMPLANTS

DELAYED (conventional)

- IMPLANT INSERTION
- HEALING PHASE - OSSEOUS INTEGRATION
- HEALING CAP
- PROSTHETIC RESTORATION

3-8 months → ~6-8 weeks
LOADING OF IMPLANTS

Early Loading

- Immediate
- 1-8 weeks
LOADING OF IMPLANTS

Immediate Loading

Within 1 week
CONTROVERSY...

**Esposito 2007**: Systematic review; it is possible to successfully load dental implants immediately or early after their placement in selected patients, although not all clinicians may achieve optimal results.

**Atieh 2009**: Systematic review; better outcomes are currently achieved using conventional loading of single implants with crowns, as opposed to immediately loaded ones, which are at a higher risk of failure.

**Harel 2013**: Retrospective chart review; immediately loaded maxillary implants showed long-term results comparable to delayed loaded maxillary implants.
SURFACE CHARACTERISTICS OF THE IMPLANTS USED IN OUR STUDY:

- Micro-textured titanium by grit-blasting the surface with HA particles
- Washing to remove the blasting media
- Coating the midsection of the implant with a band of plasma-sprayed HA coating
- Post-coating hydrothermal treatment to return the HA to a highly crystalline phase
PURPOSE AND HYPOTHESIS:

• **PURPOSE:** To assess 6-7 year success and marginal bone stability of multithreaded implants partially coated with plasma-sprayed hydroxyapatite (HA) loaded immediately or in 3 weeks after placement.

• **HYPOTHESIS:** Immediate or early loaded hydrothermally treated hydroxyapatite coated dental implants have high success rate and stable marginal bone levels in long term.
METHODS:

**Group A**
- **IMMEDIATE LOADING**
- Provisional prosthesis is placed at the day of implant placement

**Group B**
- **EARLY LOADING**
- Healing abutment is placed at the day of implant placement. Provisional prosthesis is placed 3 weeks after.
STUDY DESIGN

Day of Surgery

- Implants placed
- Group A loaded

3 Weeks

- Group B loaded

6 Months

- Follow-up and maintenance
- ISQ, Radiograph

1 Year

- Delivery of final restoration
- ISQ
- ISQ, Radiograph

18 Months

- Follow-up and maintenance
- Follow-up and maintenance
- ISQ, Radiograph

2 Years

- Follow-up and maintenance
- Radiograph

7 Years

- Follow-up and maintenance
- Radiograph
METHODS

MEASURING IMPLANT STABILITY

1. Implant Stability Quotient (ISQ)

MEASURING MARGINAL BONE LOSS

ImageJ software

At placement:
Mesial bone level: 0 mm
Distal bone level: 0.49 mm

At 2 years:
Mesial bone level: 0.62 mm
Distal bone level: 0.53 mm

At 7 years:
Mesial bone level: 0.63 mm
Distal bone level: 0.58 mm
RESULTS:

Initial Enrollment
42 patients
51 implants

2-Year Follow Up
40 patients
48 implants

7-Year Follow Up
34 patients
42 implants

1 implant failed

7-YEAR IMPLANT SURVIVAL RATE
97.62%
(n = 41/42)
(Group A = 100%, n = 20/20; Group B = 95.45%, n = 21/22)
### Mean ISQ values at different time points

<table>
<thead>
<tr>
<th>Mean (SD) ISQ Values</th>
<th>Placement</th>
<th>3 weeks</th>
<th>6 months</th>
<th>1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group A</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>±SD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>76.0 ±4.790</td>
<td>76.3 ±3.791</td>
<td>80.0 ±6.034</td>
<td>82.1 ±3.150</td>
<td></td>
</tr>
<tr>
<td><strong>Group B</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>±SD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75.3 ±4.488</td>
<td>76.6 ±4.655</td>
<td>80.6 ±6.729</td>
<td>83.2 ±5.149</td>
<td></td>
</tr>
</tbody>
</table>

![Group A Mean ISQ Values graph](image1)

![Group B Mean ISQ Values graph](image2)
Marginal bone loss at different follow-up times:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total</th>
<th>Group A</th>
<th>Group B</th>
<th>P-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2y Bone Loss</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mesial</td>
<td>0.433 ± 0.067</td>
<td>0.428 ± 0.077</td>
<td>0.438 ± 0.110</td>
<td>0.944</td>
</tr>
<tr>
<td>Distal</td>
<td>0.395 ± 0.058</td>
<td>0.395 ± 0.093</td>
<td>0.395 ± 0.075</td>
<td>0.993</td>
</tr>
<tr>
<td>Cumulative</td>
<td>0.414 ± 0.055</td>
<td>0.411 ± 0.076</td>
<td>0.417 ± 0.081</td>
<td>0.962</td>
</tr>
<tr>
<td><strong>7y Bone Loss</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mesial</td>
<td>0.479 ± 0.072</td>
<td>0.446 ± 0.090</td>
<td>0.510 ± 0.113</td>
<td>0.662</td>
</tr>
<tr>
<td>Distal</td>
<td>0.516 ± 0.053</td>
<td>0.520 ± 0.065</td>
<td>0.512 ± 0.084</td>
<td>0.945</td>
</tr>
<tr>
<td>Cumulative</td>
<td>0.498 ± 0.057</td>
<td>0.483 ± 0.064</td>
<td>0.511 ± 0.094</td>
<td>0.806</td>
</tr>
<tr>
<td><strong>2-7y Bone Loss</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mesial</td>
<td>0.046 ± 0.041</td>
<td>0.018 ± 0.072</td>
<td>0.073 ± 0.045</td>
<td>0.513</td>
</tr>
<tr>
<td>Distal</td>
<td>0.121 ± 0.049</td>
<td>0.125 ± 0.088</td>
<td>0.117 ± 0.052</td>
<td>0.935</td>
</tr>
<tr>
<td>Cumulative</td>
<td>0.084 ± 0.039</td>
<td>0.072 ± 0.071</td>
<td>0.095 ± 0.038</td>
<td>0.768</td>
</tr>
</tbody>
</table>
## Bone Loss at 7 Years Based on Study Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mesial (Mean ± Sd)</th>
<th>Distal (Mean ± Sd)</th>
<th>Average (Mean ± Sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>0.500 ± 0.439</td>
<td>0.503 ± 0.371</td>
<td>0.501 ± 0.387</td>
</tr>
<tr>
<td>Female</td>
<td>0.461 ± 0.504</td>
<td>0.528 ± 0.329</td>
<td>0.495 ± 0.363</td>
</tr>
<tr>
<td><strong>Bone Augmentation Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Augmented</td>
<td>0.305 ± 0.426</td>
<td>0.498 ± 0.383</td>
<td>0.402 ± 0.370</td>
</tr>
<tr>
<td>Non-Augmented</td>
<td>0.549 ± 0.474</td>
<td>0.523 ± 0.336</td>
<td>0.536 ± 0.370</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maxilla</td>
<td>0.348 ± 0.537</td>
<td>0.540 ± 0.308</td>
<td>0.444 ± 0.375</td>
</tr>
<tr>
<td>Mandible</td>
<td>0.545 ± 0.426</td>
<td>0.504 ± 0.367</td>
<td>0.524 ± 0.371</td>
</tr>
<tr>
<td><strong>Implant Length</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 mm</td>
<td>0.430 ± 0.000</td>
<td>0.529 ± 0.000</td>
<td>0.480 ± 0.000</td>
</tr>
<tr>
<td>10 mm</td>
<td>0.463 ± 0.380</td>
<td>0.486 ± 0.363</td>
<td>0.475 ± 0.366</td>
</tr>
<tr>
<td>11.5 mm</td>
<td>0.559 ± 0.540</td>
<td>0.562 ± 0.395</td>
<td>0.561 ± 0.422</td>
</tr>
<tr>
<td>13 mm</td>
<td>0.380 ± 0.489</td>
<td>0.478 ± 0.269</td>
<td>0.429 ± 0.320</td>
</tr>
<tr>
<td><strong>Implant Diameter</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.7 mm</td>
<td>0.628 ± 0.694</td>
<td>0.702 ± 0.210</td>
<td>0.665 ± 0.447</td>
</tr>
<tr>
<td>4.1 mm</td>
<td>0.370 ± 0.435</td>
<td>0.497 ± 0.340</td>
<td>0.433 ± 0.334</td>
</tr>
<tr>
<td>4.7 mm</td>
<td>0.495 ± 0.451</td>
<td>0.481 ± 0.377</td>
<td>0.488 ± 0.379</td>
</tr>
<tr>
<td>6.0 mm</td>
<td>0.565 ± 0.459</td>
<td>0.503 ± 0.384</td>
<td>0.534 ± 0.413</td>
</tr>
<tr>
<td><strong>Bone Type</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type II</td>
<td>0.524 ± 0.492</td>
<td>0.522 ± 0.372</td>
<td>0.523 ± 0.400</td>
</tr>
<tr>
<td>Type III</td>
<td>0.358 ± 0.415</td>
<td>0.480 ± 0.298</td>
<td>0.419 ± 0.300</td>
</tr>
<tr>
<td>Type IV</td>
<td>0.959 ± 0.000</td>
<td>0.840 ± 0.000</td>
<td>0.899 ± 0.000</td>
</tr>
</tbody>
</table>
CONCLUSIONS:

- **Mesial and distal bone levels remained relatively stable over the 6-7 year period**
- **Mean mesial and distal bone loss was less than 1 mm over 6-7 years (0.5 mm)**
- **Regression analysis showed no correlation between any of the study variables and marginal bone loss at 7 years.**
- **No significant difference in bone loss between groups A and B or mesial and distal**
- **Majority of the marginal bone loss occurred in the first 2 years**
- **Mean ISQ values increased over the first year**
CONCLUSION

After 6-7 years in function, plasma-sprayed hydroxyapatite coated tapered implants when restored in occlusion either immediately after or within 3 weeks of implant placement, had a high survival rate and stable mesial and distal marginal bone levels.
THANK YOU

Dr. Maney
Dr. Simmons
Ms. St. Germain
Dr. Palaiiologou
Ms. Billiot