The Clinical and Radiologic Outcomes of Early Loaded Implants After 5 Years of Service

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Purpose: To evaluate the 5-year results of the clinical and radiographic outcomes of three types of early loaded implants.

Materials and Methods: Seventy-five implants were placed in the posterior mandible or maxilla in 30 patients. Three types of implants (Straumann SLActive, Astra OsseoSpeed, and Thommen implant System) were used. Definitive restorations were made after 8 weeks of implant placement. The radiographs were taken at the placement of the prosthesis, at 6 months, and at 1- and 5-year follow-ups. Clinical and radiologic data were evaluated for all types of implants. The Wilcoxon signed rank test, least significant differences, and Mann-Whitney U were used to test for statistically significant differences ($P < .005$).

Results: Twenty-four patients and 62 implants were evaluated after 5 years. The mean marginal bone loss was 0.20 ± 0.40 mm, 0.21 ± 0.05 mm, and 0.25 ± 0.36 mm after 1 year and 0.32 ± 0.22 mm, 0.31 ± 0.26 mm, and 0.42 ± 0.36 mm after 5 years for the Straumann, Astra, and Thommen groups, respectively. After 5 years, the mean peri-implant probing depth level was 1.75 ± 0.49 mm, 1.87 ± 0.48 mm, and 1.92 ± 0.57 mm for the Straumann, Astra, and Thommen groups, respectively. No peri-implantitis was detected after 5 years of loading. Conclusion: All groups of implants showed a stable peri-implant probing depth and marginal bone level. The survival rate was high and bone loss was low at 5 years; thus, early loading may be a useful procedure that allows reduction in treatment time. Int J Oral Maxillofac Implants 2020;35:1248–1256. doi: 10.11607/jomi.7630

Keywords: early loading, implant stability, marginal bone loss

The early-loading implant concept has been shown to be an alternative treatment option to enhance esthetics and function to patients for prompt protection of both soft and hard tissues.1–7

To determine the loading time of the implant, one of the critical factors is primary stability during the surgical placement of the implant. The primary mechanical stability gradually decreases after the placement of an implant, and secondary stability (biologic) gradually increases.8 The primary stability is dependent on implant design (geometry, length, diameter), as well as bone quantity and quality and on the technique and accuracy of the surgical procedure.9,10

Implant surface modifications have altered the surface features to produce microrough, microporous, or nanorough surface topography11–16 or biochemical alteration through impregnation, coating, or processing.17–26

The grit-blasting and/or acid-etching method is the main surface roughening system used by many manufacturers. Recently, the gold standard of implant modifications had been proposed as microstructured, or moderately rough, sandblasted and acid-etched (SLA) implants.1,7,8,12–14,15,19 Straumann developed the standard large-grit–blasted, acid-etched SLA implant surface, which has been modified to a high level of hydrophilicity and launched as SLActive dental implants (Straumann Group).1,3,15,26

Titanium oxide blasting produces microscale surface roughness. The OsseoSpeed (Astra Tech Dental) surface is manufactured with sandblasting as well as a chemical treatment called fluoridation.16,17,21,23

Baier et al13 reported that ionized, loaded surfaces have higher surface energy than nonionized surfaces and improve hydrophilic properties for stimulating the biologic interaction between the implant and its environment. This enables improved adsorption of proteins on the surface.8 Due to an increase in new bone generation, the healing time is reduced, and early loading should be possible.10,12,24,26

The SPI (Thommen Medical) implant has a chemical alteration and hydrophilization of the titanium implant with a sandblasted and acid-etched surface. Due to the hydrophilic properties of implants, this could help the early phases of osseointegration.10,27–29

It is known that primary stability, bone modeling and remodeling, and implant surface properties are...
the main parameters influencing secondary stability. To achieve accurate primary stability, resonance frequency analysis is advocated for measuring implant stability. Ostell (Ostell Mentor) uses resonance frequency analysis to determine implant stability and osseointegration. The result is presented as an implant stability quotient (ISQ) value. Measurements are taken at implant placement for a baseline reading and again before definitive restoration.

Many clinical types of research on immediate/early loading in posterior edentulous sites have been published for short- and long-term follow-up, however, there are no long-term studies in which these three implant systems (SLActive, OsseoSpeed, and SPI) are compared with the early loading method.

This study managed a comparative analysis of the prognosis between three different types (a sandblasted and acid-etched surface, SLActive; a sandblasted surface implemented with fluoride ions, OsseoSpeed; and a sandblasted and thermally acid-etched implant, SPI) of early loaded implants organized by an experienced team in a controlled clinical follow-up study for 5-year clinical outcomes.

The null hypothesis was that (1) higher ISQ (above 71) values increase early loaded implant survival rates in the long-term analysis and (2) there is no difference in survival rates and marginal bone level between the different types of early loaded dental implant systems after 5 years of loading.

MATERIALS AND METHODS

All subjects were treated at the University of Marmara Department of Oral Surgery and Department of Prosthodontics by an experienced surgeon and prosthodontists. The implant placements and prosthetic procedures were performed by a single oral maxillofacial surgeon and a single prosthodontist (Y.O., E.K.), respectively. The Institutional Ethics at Marmara University Dentistry Faculty Committee approved the project. All patients signed the appropriate informed consent form approved by the Institutional Review Board (project no: SAG-C-DRP-030108-0001).

All subjects were able to read and sign the corresponding informed consent (at least 18 years of age) and willing to return for follow-up examinations as outlined by the investigator. The inclusion and exclusion criteria were described previously.

The type of implant was randomized using sealed envelopes. The implants used in this study were Straumann SLActive (STR), OsseoSpeed (AST), and Thommen SPI (SPI) implant systems (Table 1).

Clinical Procedures

All implants were inserted with a manual torque wrench, and resonance frequency analysis was used to determine primary stability. The flap was repositioned and sutured around dental implants as one-stage surgery. The full postoperative instructions were given to the patients. No provisional restorations were placed after surgery. ISQ was measured using the Osstell Mentor device. The initial ISQ was measured immediately after implantation before flap closure and every week after that up to 8 weeks (Table 2).

Clinical Parameters

Two experienced examiners (E.K., Y.U.A.) evaluated the following clinical parameters: (1) Plaque Index (PI), (2) Sulcus Bleeding Index (SBI), (3) peri-implant probing depth (PID), and (4) peri-implant marginal bone level. The PI, SBI, PID, and marginal bone level were assessed at the placement of the prosthesis, after 6 months, and from 1 to 5 years annually.

All implants had ≥ 70 ISQ and were loaded after 8 weeks. The prosthetic reconstructions were inserted 8 weeks after implant placement for all groups. After the laboratory procedures, metal-ceramic restorations were cemented. For cementation procedures, healing caps were removed, and abutments were inserted and torqued by a torque wrench (35 Ncm for Straumann SLActive, 25 Ncm for Astra OsseoSpeed and Thommen SPI). Then, metal-ceramic restorations were cemented with polycarboxylate cement (Adhesor Carbofine, Sofa Dental). After cementation, occlusion was carefully checked with a focus on careful occlusal adjustment to establish dynamic occlusion. Oral hygiene training was provided to all patients after cementation, and the use of occlusal splints on the maxilla was recommended for 1 month to prevent any parafunctional activity.

Clinical and Radiologic Examinations

Clinical evaluations were performed at cementation of the prosthesis and at 6 months, 1 year, and yearly thereafter. Implants with mobility were removed and regarded as a failure when peri-implant radiolucency, the slightest sign of mobility, or signs or symptoms such as pain or infection were detected. Complications regarding implants and prostheses were also recorded. Peri-implantitis was defined as peri-implant mucositis accompanied with radiographic bone loss > 2 mm from the time of prosthesis delivery.

According to these criteria, characteristics of the subjects and clinical and radiographic characteristics of peri-implant tissues in relation to peri-implant health and disease were evaluated.
Radiographic Examinations
The marginal bone loss (MBL) was measured by comparing the marginal bone level around the implant on the periapical radiograph taken at baseline implant placement with those of each follow-up radiograph as previously described.\(^3\)\(^1\) The annual MBL was calculated as described by Jung et al,\(^2\)\(^0\) and to determine successful implantation, the Albrektsson et al\(^6\)\(^2\) criteria were used.

Statistical Analysis
In this study, a descriptive statistic analysis method was used. The Wilcoxon signed-rank test was used to test for statistically significant differences over time within the different parameters and not controlled for confounding factors. All tests were two-tailed, and a \(P\) value of less than .05 was considered to be statistically significant. The relationship between stability and implant type, implant length and diameter, bone quality, and sex was assessed using least significant differences (LSD) and Mann-Whitney \(U\) tests. Patient absence to follow-up was assessed with the generalized linear models Wald and chi-square analysis.

RESULTS
A total of 30 patients (75 implants) were initially included in the study and signed the informed consent. In this study, the populations were 12 women and 18 men with a mean age of 52 ± 5.65 years (ranging from 35 to 72 years). Twenty-three implants were Straumann, 28 implants were Astra, and 23 implants were Thommen. Thirty-two implants were placed in the maxilla and 43 implants in the mandible. Regarding the diameter of implants placed, 3.5- to 4-mm implants were the most common with Straumann, while 4.5- to 5-mm implants were the most common with Astra and Thommen. In all groups, 12 -to 15-mm implants were the most common length (Table 1).

Fourteen prostheses were constructed for the maxilla and 18 prostheses for the mandible. Seventeen prostheses were two-implant–supported three-unit fixed partial dentures (FPDs).

All implants placed in this study had > 75 ISQ values at the baseline and > 70 ISQ values after 8 weeks before prosthesis loading. Implant stability (ISQ values) in each group at a measured time; the relationship between ISQ values and sex, arch, and bone quality; and the relationship between ISQ values and implant dimensions have been presented previously (Table 2).\(^3\)\(^2\)

No implants of the followed patients were lost at all the follow-ups in this study. However, six patients with 13 implants placed (13 of 75 implants) were excluded from the study after 2 years because they did not attend a recall visit after 2 years (three deaths, two moved to another country, and one did not want to come). Thus, a total of 24 patients, with a total of 62 implants, were followed in this study for 5 years (Tables 3 and 4).

All implants were clinically stable, and no mobility was observed at the 5-year recall. All implants were considered as successful implants after 5 years of clinical and radiologic examinations (Figs 1 to 3). For the three groups, the survival rate of implants and prosthesis was 100% (Tables 3 and 4).

### Table 1 Features of Implants Used in This Study

<table>
<thead>
<tr>
<th>Implant name/study name</th>
<th>Manufacturer</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLActive (STR) Straumann AG</td>
<td>The standard large-grit–blasted, acid-etched SLA implant surface has been modified to a high level of hydrophilicity.</td>
<td></td>
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<tr>
<td>OsseoSpeed (AST) Dentsply Implants</td>
<td>A sandblasted surface implemented with fluoride ions.</td>
<td></td>
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<tr>
<td>SPI (SPI) Thommen Medical</td>
<td>A sandblasted and thermally acid-etched implant.</td>
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</table>

### Table 2 Mean, SD, and P value of ISQ Values Obtained at Each Time Measurement for All Groups

<table>
<thead>
<tr>
<th>Time</th>
<th>STR (n = 23)</th>
<th>AST (n = 28)</th>
<th>SPA (n = 24)</th>
<th>(P)</th>
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<tbody>
<tr>
<td></td>
<td>Mean SD</td>
<td>Mean SD</td>
<td>Mean SD</td>
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<tr>
<td>Baseline</td>
<td>78.39 3.95</td>
<td>76.57 5.12</td>
<td>75.13 5.72</td>
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<tr>
<td>1 wk</td>
<td>76.65 4.23</td>
<td>74.75 5.63</td>
<td>73.13 5.58</td>
<td>.1</td>
</tr>
<tr>
<td>2 wk</td>
<td>75.00 4.55</td>
<td>73.18 5.54</td>
<td>70.54 6.05</td>
<td>.03</td>
</tr>
<tr>
<td>3 wk</td>
<td>75.13 4.65</td>
<td>72.86 5.54</td>
<td>70.29 5.97</td>
<td>.02</td>
</tr>
<tr>
<td>4 wk</td>
<td>75.91 4.48</td>
<td>73.68 5.65</td>
<td>70.88 6.02</td>
<td>.01</td>
</tr>
<tr>
<td>5 wk</td>
<td>76.09 4.49</td>
<td>74.36 5.55</td>
<td>71.25 5.93</td>
<td>.02</td>
</tr>
<tr>
<td>6 wk</td>
<td>76.17 4.45</td>
<td>74.71 5.54</td>
<td>71.42 5.96</td>
<td>.02</td>
</tr>
<tr>
<td>7 wk</td>
<td>76.17 4.45</td>
<td>74.79 5.52</td>
<td>71.50 5.99</td>
<td>.02</td>
</tr>
<tr>
<td>8 wk</td>
<td>76.17 4.45</td>
<td>74.79 5.59</td>
<td>71.50 5.99</td>
<td>.02</td>
</tr>
</tbody>
</table>
The main effects of time and implant type on the mean of loss were statistically significant ($P < .001$ and .032, respectively). When the main effect of time is analyzed, initial loss was at the lowest level with 1.093. In the sixth month, the average value was 1.316; it was 1.526 in the first year, and there is no difference between the average loss values at these times. The average loss in the fifth year was highest at 2.112 mm. When the implant types are examined, the average loss in the Astra group was 1.312 mm, while in the Straumann group, it was 1.562 mm, and in the Thommen group, it was 1.561. The lowest loss was obtained in the Astra group. The amount of losses obtained in the Straumann and Thommen groups do not differ from each other, and the highest losses were obtained in these
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implant types. The interaction of time and implant type does not have a significant effect on the amount of losses ($P = .632$; Tables 3 and 4). In other words, which implant type caused how much loss at which time was not found to be statistically significant. The number of implants was added to the model as a covariate variable, and it was observed that there was no significant effect on amount of losses ($P = .735$).

**Clinical Parameters**

Peri-implant soft tissue was healthy after 5 years. There were no recessions and no exposure of the abutments. No implants for each group showed signs of peri-implantitis, according to the measurements taken at different time points, including PI, SBI, PID, and marginal bone level change.

There was no statistically significant difference among groups for PI and SBI values in all observation times (Mann-Whitney $U$ test, $P > .05$). The PID was found to be $1.00 \pm 0.01$ mm, $1.23 \pm 0.30$ mm, and $1.37 \pm 0.35$ mm for Straumann, Astra, and Thommen implants, respectively, at baseline. After 5-year evaluations, this score was changed to $1.75 \pm 0.49$ mm in the Straumann group, $1.78 \pm 0.63$ at baseline and 5 years, respectively. The PID values for implants placed in the maxilla were $1.08 \pm 0.05$ and $1.78 \pm 0.63$ at baseline and 5 years, respectively. All groups showed a statistically significant increase in PID values with time (Wilcoxon signed rank test, $P = .01$). The SPI group showed significantly greater PID values than Astra and Straumann implants for all time measurements ($P = .01$).

There was no statistically significant difference in PID values between the maxilla and mandible after 5 years ($P > .05$). The MBL values were $0.14 \pm 0.05$ mm, $0.13 \pm 0.48$ mm, and $0.18 \pm 0.38$ mm for Straumann, Astra, and Thommen, respectively. At 1-year evaluations, MBL values were $0.20 \pm 0.40$ mm for Straumann, $0.21 \pm 0.35$ mm for Astra, and $0.25 \pm 0.36$ mm for Thommen. The MBL values were $0.32 \pm 0.22$ mm in STR, $0.31 \pm 0.26$ mm in AST, and $0.42 \pm 0.36$ mm in Thommen at 5 years (Table 6). All groups showed a statistically significant increase in MBL values with time (Wilcoxon signed rank test, $P = .01$). The SPI group showed significantly greater MBL values than Astra and Straumann implants for all time measurements ($P = .01$).

### Table 5

<table>
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<tr>
<th>Arch</th>
<th>Maxilla</th>
<th>11</th>
<th>11</th>
<th>11</th>
<th>32</th>
<th>10</th>
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<th>11</th>
<th>17</th>
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<th>43</th>
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<tr>
<td></td>
<td>Mandible</td>
<td>11</td>
<td>11</td>
<td>11</td>
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<td>13</td>
<td>13</td>
<td>13</td>
<td>43</td>
<td>43</td>
<td>43</td>
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<tr>
<td>Implant diameter (mm)</td>
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<td>10</td>
<td>7</td>
<td>17</td>
<td>19</td>
<td>2</td>
<td>25</td>
<td>4</td>
<td>8</td>
<td>16</td>
<td>17</td>
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<td></td>
<td>4.4–4.1</td>
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<td>4</td>
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<td>11</td>
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<td>4</td>
<td>5</td>
<td>17</td>
<td>4</td>
<td>5</td>
<td>17</td>
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<tr>
<td>Implant length (mm)</td>
<td>9–10</td>
<td>11</td>
<td>4</td>
<td>18</td>
<td>11</td>
<td>8</td>
<td>37</td>
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<td>8</td>
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<td>11</td>
<td>8</td>
<td>37</td>
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<tr>
<td></td>
<td>13–15</td>
<td>1</td>
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<td>20</td>
<td>1</td>
<td>2</td>
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<td>1</td>
<td>2</td>
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</table>

### Table 6

<table>
<thead>
<tr>
<th>No. of implants; PID; Mean (SD)</th>
<th>Baseline</th>
<th>6 mo</th>
<th>1 y</th>
<th>5 y</th>
<th>Baseline–6 mo</th>
<th>Baseline–1 y</th>
<th>Baseline–5 y</th>
</tr>
</thead>
<tbody>
<tr>
<td>STR</td>
<td>23; 1.00 (0.01)</td>
<td>23; 1.23 (0.30)</td>
<td>23; 1.37 (0.35)</td>
<td>21; 1.75 (0.49)</td>
<td>23; 0.14 (0.05)</td>
<td>23; 0.20 (0.40)</td>
<td>21; 0.32 (0.22)</td>
</tr>
<tr>
<td>AST</td>
<td>28; 1.16 (0.33)</td>
<td>28; 1.34 (0.43)</td>
<td>28; 1.49 (0.37)</td>
<td>20; 1.87 (0.48)</td>
<td>28; 0.13 (0.48)</td>
<td>28; 0.21 (0.05)</td>
<td>20; 0.31 (0.26)</td>
</tr>
<tr>
<td>SPI</td>
<td>24; 1.18 (0.31)</td>
<td>24; 1.36 (0.38)</td>
<td>24; 1.58 (0.51)</td>
<td>21; 1.92 (0.57)</td>
<td>24; 0.18 (0.38)</td>
<td>24; 0.25 (0.36)</td>
<td>21; 0.42 (0.36)</td>
</tr>
<tr>
<td>Maxilla</td>
<td>32; 1.08 (0.05)</td>
<td>32; 1.26 (0.45)</td>
<td>32; 1.43 (0.49)</td>
<td>25; 1.78 (0.63)</td>
<td>32; 0.12 (0.25)</td>
<td>32; 0.23 (0.45)</td>
<td>25; 0.40 (0.25)</td>
</tr>
<tr>
<td>Mandible</td>
<td>43; 1.13 (0.27)</td>
<td>43; 1.33 (0.37)</td>
<td>43; 1.56 (0.55)</td>
<td>37; 1.89 (0.74)</td>
<td>43; 0.16 (0.35)</td>
<td>43; 0.19 (0.18)</td>
<td>37; 0.35 (0.209)</td>
</tr>
</tbody>
</table>
All MBL values were less than 0.5 mm after 5 years. The MBL values for implants placed in the maxilla were 0.23 ± 0.45 mm after 1 year and 0.19 ± 0.25 mm after 5 years. For the mandible, these values were 0.40 ± 0.18 after 1 year and 0.35 ± 0.35 after 5 years. When MBL values were compared between the maxilla and mandible, no significant differences were observed in each measurement (P = .425).

Concerning technical and mechanical complications, after loading and over the 5 years, no patients experienced abutment loosening, chipping, and fracture for all metal-ceramic restorations.

**DISCUSSION**

It is essential to know whether there are implant systems or specific implant characteristics associated with increased success rates, primarily for the patient’s benefit, for early loaded implants in the long term. To determine the efficiency of different implant systems with the early loading concept, well-conducted long-term studies are needed.

This study focused on comparing the influence of three different types of implant surfaces (a sandblasted and acid-etched surface, SLActive [STR]; a sandblasted surface implemented with fluoride ions, OsseoSpeed [AST]; and a sandblasted and thermally acid-etched surface [SPI]) on clinical outcomes and marginal bone levels after 5 years of early loaded implants organized by the experienced team.

The survival rate of implants was 100% in the present study.

Cochran et al. reported a 99% and 98.8% success rate for early loaded SLA implants after 2 and 5 years, respectively. Kokovic et al. reported a 100% survival rate in early loaded SLA implants after 5 years. In this study, also, early loaded SLA (STR group) implants showed a 100% survival rate after 5 years, complying with other studies.

Jaquiéry et al. evaluated early loaded ELEMENT implant line (similar to the Thommen implant used in the present study) for clinical and radiographic performance during 5 years. They stated that after 5 years, only one implant was lost. They reported an early implant failure ratio of < 1% (1 of 114). In the present study, early loaded Thommen implants showed a 100% survival rate after 5 years, which is higher than Jaquérie et al.’s study.

Schliephake et al. and Mertens and Steveling evaluated the clinical effect of a fluoride-modified implant surface over a long-term follow-up. They showed a high survival rate over a 5-year follow-up period: 100% for the mandible and 97% for the maxilla. In the present study, early loaded Astra implants showed a 92.9% survival rate after 5 years, which is higher than the aforementioned studies.

The success rates between 96.75% and 98.1% shown in many studies focused on immediate loading with ISQ values > 60.10,29,50 In the present study, for assessing the primary implant stability, resonance frequency analysis was measured using an Osstell device. The ISQ values were measured at the implant placement and 1 week to 8 weeks. The mean ISQ value for implants tested was above 75 at the time of placement and above 71 after 8 weeks, as shown previously. The pattern of ISQ changes in this study was similar to the studies by Oates et al. and Held et al. with 10 tested implants with chemically modified surfaces that were identical to the present research. They stated that implants showed an initial decrease in the ISQ values within the first 2 weeks. After 6 weeks, the ISQ values returned closer to starting values, complying with the present result as previously described.

This study showed that higher ISQ values (> 71) increase the early loaded implant survival rate in the long-term analysis. Thus, the first null hypothesis was fully accepted (Table 2).

Peri-implant probing depth (PID) may be considered as a diagnostic marker for evaluating inflammation and infection around dental implants.60–63 Lindhe et al.60 and Misch stated that the presence of ≤ 3 mm of pocket depth indicated healthy peri-implant tissue. All the implant systems showed an increase in PID value, and at the end of 5 years, the highest average pocket depth was ≤ 2 mm. However, this increase is within the clinically acceptable limits stated by Lindhe et al.60 and Misch. These results may be explained by the fact that this was a controlled study, and patients were given oral hygiene education during all recall studies. Capelli et al. and Zuffetti et al. reported that with patients with well-maintained oral care, complications are uncommon, and healthy and stable peri-implant tissues can be preserved for 55 and 1056 years around immediately and early loaded implants. The present study complies with these studies.

Besides the analysis of implant stability, another emphasis of the present research was the assessment of the MBL. The MBL values were 0.32 ± 0.22 mm in Straumann, 0.31 ± 0.26 mm in Astra, and 0.42 ± 0.36 mm in Thommen at 5 years. Although all groups showed a statistically significant increase in MBL with time, MBL values were less than 0.5 mm after 5 years for three groups. The Thommen implants showed higher MBL values than the Straumann and Astra groups; besides, the pattern of MBL was virtually identical for all groups. Approximately 0.25 mm of bone was lost during the first year. MBL for implants placed in the maxilla was 0.19 ± 0.25 mm, and for the mandible, it was 0.40 ± 0.18 mm after 5 years. The placement of the
implants in the maxilla and mandible did not have an effect on bone resorption at early loaded implants in the posterior region after 5 years (Table 4). All implants in this study were considered as successful according to Albrektsson and Lindén.52

MBL Evaluated for Implant Types

Straumann (SLActive) implants showed 0.32 ± 0.22 mm MBL after 5 years in this study. Clinical findings have revealed that early loaded SLA implants can have outstanding outcomes of restorations in different types of bone with stable crestal bone levels.36–37,52,53 Kokovic et al53 also showed 0.8 ± 0.15 mm MBL after 5 years for early loaded modified SLA surface implants. The present study results comply with studies with early loaded SLA surface implants.

Astra (OsseoSpeed) implants showed 0.31 ± 0.22 mm MBL after 5 years. Schliephake et al52 showed that implants with a fluoride-treated grit-blasted surface revealed a high degree of predictability for MBL maintenance and peri-implant soft tissue status when early loaded in the posterior mandible. Mertens and Steveling54 investigated the long-term results of OsseoSpeed implants, and 42 implants placed in 15 patients were assessed over 5 years. They found a mean marginal bone loss of 0.1 mm after 5 years. The present study’s results comply with studies with early loaded OsseoSpeed implants.52,54

SLA (Thommen SPI) implants showed 0.42 ± 0.36 mm MBL after 5 years. Jaquière et al42 found that the mean bone level of early loaded SPI dental implants was located 0.3 to 0.4 mm and 0.1 to 0.2 mm below the rough/smooth border for early loaded SPI implants after 1 and 5 years, respectively. They stated that the peri-implant bone remained stable at the level above the first thread during this period.

Many scientific studies focused on the influence of structured and chemically modified implant surfaces for rapid osseointegration.17,11 Because surface treatment procedures could shorten the healing time of dental implants, early loading of implants could be possible.12 To reduce implant loading time, several manufacturers focus on chemical modification of the surface.19 Studies have shown that such surfaces can lead to improved and faster bone healing.8,10,19 In the present study, three different implant systems were used: a novel hydrophilic Straumann implant with an SLActive surface (STR), OsseoSpeed Astra Tech implant (AST) novel microthreads, and surface treatment with fluoride ions and SPI (SPI) implants modified by hydroxide ions sandblasted and thermally acid etched. After 5 years of loading, all implants examined for the three groups have been stable and in situ.

This study showed that there was no difference in survival rates and marginal bone level between the different types of early loaded dental implant systems after 5 years of loading. Thus, the second hypothesis in this study was also fully accepted.

This study showed that high success rates could be achieved for all implant systems analyzed after 5 years of early loading. Although a relatively small number of patients were included in this study, for three different surface types of implants, the crestal bone level was maintained stable after 5 years of early loading. These encouraging results may be due to the development of implant surface topographies in three types of implants, appropriate case selection, and ideal surgical and prosthetic management produced by the experienced team. Therefore, caution should be exercised by less experienced dentists when applying early loading procedures.

The advantage of this study design was its prospective planned nature and performance of randomization, so the result may be useful for making comparisons of the different implant systems with early loading. Future studies should investigate different loading protocols for the different types of bones, the different types of structures, the effect of splinting vs no splint in structure, and occlusal factors as potential variables in the healing process.

CONCLUSIONS

Within the limitations of this prospective clinical study, it can be concluded that different chemically modified implants support early osseointegration. The results of this study confirm the beneficial effect of surface modification on implant survival in the immediate/early loading protocol. Further studies with higher implant numbers and more extended observation periods are necessary to allow for general recommendations regarding shorter healing periods for different types of implants.

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REFERENCES


