

# Implant-Supported Prosthesis Misalignment Related to the Dental Arch: A 14-Year Clinical Follow-up

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The purpose of this study was to warn the dental community about a possible problem in function with partial implant-supported prostheses used for long periods. The misalignment between natural teeth and the implant-supported prosthesis on teeth 11 and 12, observed in a 14-year clinical follow-up, illustrates the fact. The metal-ceramic crowns were placed in 1995 after a rigorous occlusal adjustment. Evaluations were made at 4, 6, 9, and 14 years, when it was noticed that the restorations were positioned palatally and extruded in comparison with the natural teeth. After 9 years, a greater discrepancy was noticed, with anterior occlusion and esthetic changes. The possible causes have been discussed: occlusal problems, parafunctional habits, and natural movement. The first 2 options were discarded after clinical analysis and diagnosis. Therefore, the natural movement probably deriving from an interaction of mechanical and genetic factors might have been the cause. The implants do not have periodontal ligaments but rather ankylosis, so they do not suffer those movements. This case emphasizes the need to inform patients that implants can last more than 10 years in function, but this is not the case with restorations, which lose function and esthetics and must be replaced.

**Key Words:** *misalignment, implant-supported prostheses, follow-up, partially edentulous, osseointegrated implants*

## INTRODUCTION

**O**sseointegrated implants have been used to rehabilitate edentulous patients for more than 40 years. At first, the implants were used to rehabilitate totally edentulous arches. Today, dental implants are also used in partially edentulous and even single-tooth areas with high esthetic demands, such as the upper incisors. The loss

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of these dental elements by trauma is very frequent,<sup>1</sup> not only in children but also in adults, especially with accentuated overjet and increased interlabial space.<sup>2,3</sup> In these situations, replacing missing teeth with an implant-supported prosthesis may be the treatment of choice.<sup>4</sup>

Nowadays, the high success rate achieved by, the predictability of, and the longevity of implant-supported prostheses<sup>5</sup> make this rehabilitation method an increasingly used option in dentistry.<sup>6-10</sup> Nonetheless, after years of use of osseointegrated implants and implant-supported prostheses, some problems have been reported in the literature, such as loosening and fracture of screws and fracture of prostheses and implants.<sup>10-13</sup> More recently, some cases of misalignment between upper anterior implant-supported crowns and adjacent natural teeth have also been reported.<sup>14-18</sup>

The stomatognathic system is composed of organs and live tissues; consequently, it suffers constant changes. Bone changes that occur in children and young individuals at greater rate are also observed in adults.<sup>19</sup> The teeth tend to follow these changes, but the fixed crowns on osseointegrated implants do not follow this movement.<sup>14</sup> The teeth are connected to the bone tissue by the periodontal ligament (PDL). The PDL allows such movement through bone remodeling, where the bone tissue is resorbed and new bone is formed.<sup>20</sup> On the other hand, the implants are juxtaposed to the bone, which does not allow the prosthetic crowns to follow the migration of natural dental elements.<sup>21</sup>

This article aims to disseminate a problem that can frequently occur in the upper implant-supported prostheses. This situation has been observed and is depicted in a patient and can be demonstrated by comparing photographs of the positioning of the crowns of the upper right central and lateral incisor related to the dental arch. The series of photographs was taken at the installation visit and after 4, 6, 9, and 14 years in function.

## CLINICAL CASE

The patient described in this study suffered a motorcycle accident when he was 33 years old, with consequent avulsion and fracture of the upper right central and lateral incisors. When the patient was still in the hospital, a temporary adhesive prosthesis with provisional teeth was made to replace the 2 missing teeth. After 5 months, the patient sought treatment with osseointegrated implants.

A radiologic guide was made on the diagnostic cast after the waxing up with putty silicone, and this guide was later transformed into the surgical guide used during the implant placement procedure. Two Nobelpharma implants (NobelBiocare AB, Gothenburg, Sweden) were installed following the 2-stage protocol and were left submerged with coverage screws for 6 months. After the osseointegration period, the reopening of the implants for installation of the healing abutments was performed, followed by the readaptation of the temporary adhesive prosthesis. Eleven days after the second-stage surgery, the healing abutments were removed, and 2 CeraOne (NobelBiocare AB) prosthetic abutments were installed to allow the fabrication of the final restoration. The implant-supported provisionals were made on the same abutments using the temporary cylinder for the CeraOne abutments. The impression for the final restoration was also obtained at the same clinical appointment. In April 1995, the 2 ceramic crowns were tried in and adjusted accurately according to the shape and contour of the neighboring teeth and arches and also according to centric and eccentric movements (centric relation, protrusion, and right and left excursions). After glazing, the prostheses were permanently installed with zinc phosphate cement. The satisfactory alignment between the 2 crowns and the upper teeth can be observed by occlusal and buccal view after the installation (Figures 1 and 2).

The patient's first return appointment was 2 years after delivery of the crowns, in



**FIGURES 1–2.** **FIGURE 1.** Immediately postinstallation: 1995. **FIGURE 2.** Immediately postinstallation: 1995.

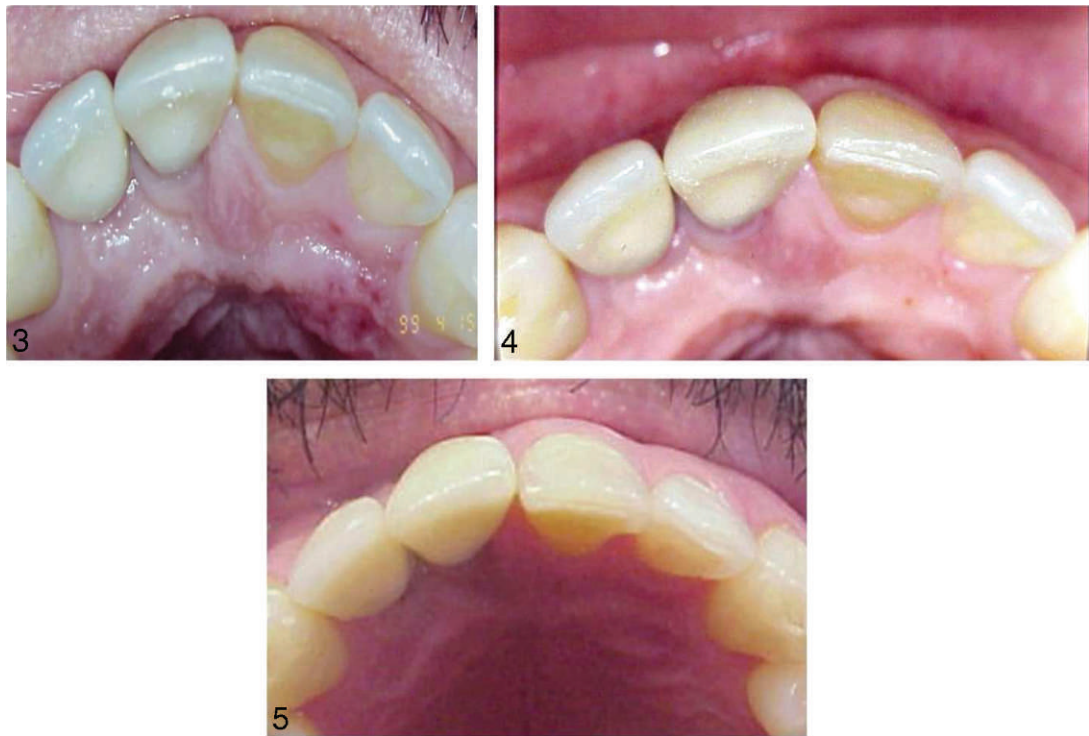
June 1997. At that time, no clinical problems or changes were noticed in the prostheses. The buccal-lingual and the occlusal relationships between the prosthetic crowns and natural teeth were very similar to those obtained at the time of the delivery. The second follow-up appointment was performed in April 1999. At this appointment, a slightly lingual misalignment of the natural teeth was noticed (Figure 3). A slight extrusion of the natural teeth related to the crowns was also observed during this 4-year follow-up visit. Since this particular clinical case is used didactically in continuing education courses and presentations, the monitoring of the crowns was conducted as routine. However, when analyzing these photos in projection, it was possible to identify and quantify the misalignment as about 0.3 mm buccally. It would be very difficult to detect such a situation in a routine clinical follow-up visit.

In April 2001, the patient returned for another follow-up visit. The crowns had never become loose nor had been removed since the installation. The misalignment had caused a small esthetic change, but the patient had no complaints about it (Figure 4). In 2004, 9 years after the crowns' installation, the misalignment was slightly larger and was causing changes in occlusion eccentric movements and esthetics (Figure 5). Since the patient did not have any complaint at that point, only the occlusion was adjusted. After 14 years

in function, in 2010 (Figures 6 and 7), the relationship between the natural teeth and implant-supported crowns remained the same as it was in 2004. It is possible to notice clearly the lingualization and extrusion of the natural teeth compared with the crowns. Even though the patient is fully aware of the situation and how it happened, he never opted for the replacement of the ceramic crowns.

#### DISCUSSION

Fixed prostheses on osseointegrated implants present a high success and survival level and are a stable treatment if done correctly, with few problems. Nonetheless, restorations on implants have higher survival rates when compared with any other type of dental prosthesis.<sup>5</sup> The osseointegrated implants are advertised to the patients as a treatment that presents longer functional longevity. The prostheses that are fabricated on top of the implants, on the other hand, may fail sooner, and there may be a need for their replacement after a shorter period of time. There is a higher probability of losing an implant during its first year compared with the second year and more so in the second than in the third year, and so on. This fact leads to the wrong idea that an implant-supported prosthesis with 3 years will hardly fail. Despite the fact that the implant probably does not present any problems, the prosthesis itself may need to



**FIGURES 3–5.** **FIGURE 3.** Installation visit after 4 years: 1999. **FIGURE 4.** Installation visit after 6 years: 2001. **FIGURE 5.** Installation visit after 8 years: 2004.

be replaced as a result of what has been explained in this report.

The problem of misalignment of long-term implant-supported prostheses in relation to the dental arch is a clinical situation that is not very often reported in the literature, especially in patients older than 30 years.<sup>14,16</sup> Nevertheless, the discussion of this situation is of great importance in rehabilitation with osseointegrated implants. The esthetics of the individual can be compromised, and the functionality of the stomatognathic system may be impaired.<sup>17,18</sup>

The factors that cause such misalignment should be the subject of a more accurate study, in which one can try to understand how it may happen. Lennart Lysell in 1958<sup>22</sup> observed that the teeth mostly affected by mesiodistal attrition are the lower molars and the lower and upper incisors and that this characteristic attrition normally begins at 23 to 26 years of age. This is a condition that can cause physiological migration of the teeth. The dynamics of the stomatognathic system, with

various forces acting on teeth surfaces, cause the teeth to wear by attrition, having a dimensional decrease in the mesiodistal direction.<sup>23,24</sup>

Osseointegrated implants, contrary to the natural dentition, do not biologically migrate and show a slow continuous eruption, as we can observe in young adult patients who may or may not have totally erupted permanent teeth.<sup>21,25</sup> Even during adulthood, after the growth phase has ended, we still have dentofacial changes caused by the constant bone remodeling that occurs throughout one's entire life.<sup>19,25</sup> The teeth follow this bone-remodeling pattern because of the PLD. The same is not true of dental implants, which causes the discrepancy in their positioning in relation to the natural teeth.<sup>16,17</sup> It also happens because implant-retained prostheses do not become secondarily displaced in space like teeth during growth of the maxillary.<sup>14</sup>

The lack of occlusal stability, especially with the presence diastemas, could facilitate this discrepancy,<sup>14</sup> but it was not the



**FIGURES 6–7.** **FIGURE 6.** Installation visit after 14 years: 2010. **FIGURE 7.** Installation visit after 14 years: 2010.

case of the patient presented in this report. The patient also has not shown any parafunctional habit, which was evaluated in the first and subsequent appointments and throughout the entire period. Iseri and Solow<sup>24</sup> and Thilander<sup>25</sup> observed an infraocclusion of 0.1 mm per year in cases similar to the one presented in this report. In the presented case, the amount of change per year was not quantified; however, the initial and final photographs show discrepancies compatible with the statement above.

Dental implants should not be installed in children or in individuals who still present erupting teeth other than the third molars. Implants also should not be installed in individuals who are still undergoing bone growth.<sup>26</sup> The literature presents several studies with patients at different ages (Table). This patient was 34 years old by the time the implants were inserted, and this case has been followed up over 14 years. At this age, bone growth has already ceased, but major changes

occurred slowly in the long-term. The possible stabilization of skeleton development does not mean that misalignment of the implant-supported prosthesis will not occur, and even with full development of the facial bones, such movements may still be occurring. The long-term misalignment of implant-supported prostheses in relation to the adjacent teeth is a situation rarely seen in clinical dentistry, and it may be caused by an interaction of genetic and mechanical factors. Since the main reason for this condition is still uncertain, more investigations must be conducted to fully understand how it happens.

**Possibilities of prevention and the problem solution**

Osseointegrated implants, especially for esthetic situations, should not be installed in patients who are still undergoing bone growth. Since this problem has already been observed in patients who have stopped bone growth, the placement of implants in young patients with such complications may be more significant in esthetic cases.

Orthodontic movements, if necessary, should be planned and conducted before installation of the implants, preventing any occlusal instability that could allow for future tooth movement and misalignment. In specific cases of implants in the anterior maxilla, situations such as occlusal stability, interproximal contacts, and good stability between the upper and lower incisors should be observed and adjusted prior to

TABLE		
Longitudinal studies of implant and tooth relationships		
Age Range, y	Follow-up Period, y	Reference
14–19	8	14
15.5–21	4	15
40–55	5	15
27	10	16
25	16	17
26.1 (±11.4)	15	18

implantation to reduce the risk of an infraoccluded position. If the misalignment occurs despite considering all preventive measures, the replacement of the prosthetic crowns will be necessary to provide the esthetics and functionality of the stomatognathic system.

### CONCLUSION

Despite the low incidence of the issue presented here, the patient who is looking for treatment with osseointegrated dental implants in the anterior region must be informed about the possibility of the presented situation.

The importance of regular follow-up appointments after the rehabilitation delivery must be strongly emphasized. In some situations, the replacement of the crowns with new ones following the new alignment of the teeth may be necessary after a period of between 8 and 14 years.

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