Treatment of an 18-year-old female patient with a congenitally missing tooth

Implant placement in the aesthetic zone upon completion of growth

Dr Dr Snježana Pohl, Rijeka, Croatia

Skeletal growth is generally completed in girls at around age 17, and in boys around age 19. However, with completion of skeletal growth radiologically established, there will still be residual vertical growth of the dentoalveolar complex, which is why dental implant placement should be postponed somewhat beyond this time. This case presents an 18-year-old female patient with a H.1.i defect of the alveolar ridge according to the Cologne Classification of Alveolar Ridge Defects (CCARD), where implant placement in the aesthetic zone was delayed for a year after the completion of growth as radiologically established. Using minimally invasive surgical techniques, some horizontal alveolar ridge volume was built, and the following year an implant was placed in the expanded alveolar ridge.

Dental implants and skeletal growth

Dental implants can ankylose in the jawbone. Their placement should be delayed until the completion of skeletal growth. Skeletal growth is generally completed in girls at around age 17, and in boys around age 19, but there may be some residual growth for a few years [1].

We all remember our orthodontics lectures and the impressive images of metallic implants inserted in order to analyse skeletal development [2]. Metal implants showed that the maxilla and mandible develop in an anterocaudal direction.

If the dental implant is inserted before skeletal growth is complete, there will be a vertical ledge between the implant-supported crown and the adjacent teeth (Fig. 1). The ankylosed implant cannot follow the further development of the dentoalveolar complex. The logical consequence is that the implant crown, when in the posterior jaw, will be in infraocclusion, which can result in functional problems. In the visible part of the dentition, aggravating aesthetic problems can develop.

There are several methods of determining skeletal maturity: ultrasound exams of the arm [3], analysis of the cervical vertebrae [4] and the frontal sinus [5], and X-rays of the hand [6,7]. In the dental office, especially in orthodontics and, more recently, in implantology, hand X-ray is the most widely applied method. Radiological signs of completed skeletal growth are diaphyseal-epiphyseal fusion of the radius and ulna [7]. However, the literature states that residual growth can continue for about two years, especially in boys. What amount of growth – especially vertical growth – of the dentoalveolar complex must be expected?

Fig. 1 Diagram of implant 21 inserted before completion of jaw growth. The implant crown is shorter, and the gingival margin is higher.

Fig. 2 Average smile line.

Fig. 3 Horizontal atrophy of the alveolar ridge at site 12. Aesthetically inadequate composite restoration on tooth 22.

Fig. 4 Retainer that also carries the provisional tooth 12. Pronounced horizontal atrophy due to agenesis of tooth 12.

Fig. 5 Divergent roots of adjacent teeth. Apical lesion of tooth 46.

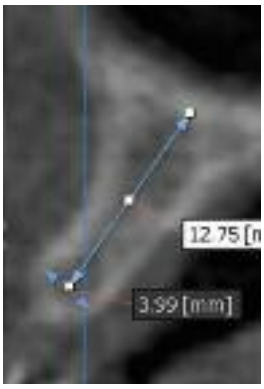

Fig. 6
CT shows 4 mm wide alveolar process.

Of particular interest were the results of a radiographic and cephalometric analysis of 56 subjects observed over five years [8]. After establishing completion of skeletal growth based on hand X-rays, 81 per cent of subjects showed less than 1 mm of dentoalveolar complex growth in a vertical and sagittal direction. However, the other 19 per cent exhibited growth of more than 1 mm, averaging 1.6 mm. One patient showed a full 2.5 mm of vertical "growth after growth was completed".

Since even a "mere" 1 mm is not negligible in the aesthetic zone, the authors of this study recommend delaying the insertion of implants in the aesthetic zone for a few years after the completion of growth has been radiologically established.

Fig. 7
The patient appears to be younger than her chronological age of 18 years.

Case report

An 18-year-old female patient was referred for implant placement at site 12 after completion of orthodontic treatment; tooth 12 was congenitally missing. There was also microdontia of the contralateral tooth 22. Orthodontic treatment had created a space at the site of the missing tooth that was sufficient for implant placement. A retainer with an attached composite tooth served as a provisional.

The smile line was average (Fig. 2). There was pronounced horizontal atrophy of the alveolar ridge (Figs. 3 and 4). The orthopantomograph showed divergent roots of adjacent teeth, which was convenient for implant placement. As an additional finding, an asymptomatic apical lesion of tooth 46 was diagnosed (Fig. 5). The CT showed an alveolar ridge width of 4 mm, which, in the maxilla, is sufficient for implant placement with careful bone expansion (Fig. 6).

However, our lovely patient sitting in the dental chair seemed very young. She looked more like a girl than a young woman (Fig. 7).

Fig. 8 The hand X-ray shows a discrete demarcation of the radius and ulna epiphyses. No lateral notches.

Fig. 9 Free subepithelial connective-tissue graft, made to overlap a few times.

Fig. 10 Placing the graft using the tunnelling technique.

Fig. 11 Result immediately after reinforcement of the alveolar ridge.

Fig. 12 One year after the first X-ray, no demarcations of radius and ulna epiphyses are visible.

Fig. 13 Appearance of the alveolar ridge one year following reconstruction.

Fig. 14 Horizontal dimensions of the alveolar ridge.

A hand X-ray showed a visible transition zone between the epiphysis and diaphysis of the ulna and radius, but no visible lateral notches (Fig. 8). This finding indicated that growth had just been completed. Given that the final aesthetic result in this case was very important and that there was a significant risk of further vertical growth, the patient was advised to postpone treatment for a year.

Due to the extreme horizontal atrophy of the alveolar ridge, a free connective-tissue graft was used for reconstruction.

Figure 9 shows a connective-tissue graft harvested from the palate using a single-incision technique. A long transplant was made to overlap several times in order to get as much volume as possible. The graft was inserted using the tunnelling technique to avoid unnecessary incisions and papillae elevation (Fig. 10). Figure 11 shows the result immediately after surgery. The palatal wound was closed with compression sutures.

A year later, at age 19, there were no visible epiphyseal transitions of the radius and ulna left (Fig. 12). Figures 13 and 14 indicate the vertical and horizontal dimensions of site 12 prior to implant placement.

Fig. 15 Bone expansion using bone spreaders.

Fig. 16 Implant (Astra, Dentsply Implants) placed using a minimally invasive technique.

Fig. 17 Status eight months after definitive prosthetic rehabilitation.

Fig. 18 The smile line of the satisfied patient is significantly higher than at the beginning of therapy.

A minimally invasive technique without flap reflection and papilla elevation was used to prepare the implant site. Given the reduced volume of the alveolar ridge, the preparation was carried out using osteotomes and bone spreaders (Fig. 15). This is not only a non-invasive form of implant-site preparation, but also accomplishes further gains in the horizontal dimension of the entire ridge (Fig. 16). Thanks to proper implant placement in the 3D comfort zone, there were no difficulties in creating the emergence profile of the crown.

Figure 17 shows the harmoniously integrated implant-supported crown eight months after the definitive prosthetic rehabilitation. Both papillae are visible; the level and shape of the gingival margin are identical to those of tooth 22. Gingival colour and texture are indistinguishable from the surrounding gingiva.

Again we were able to observe how the smile line becomes higher when a satisfied patient becomes more self-confident. This patient ended up developing a high smile line (Fig. 18).

Fig. 19 Successful endodontic therapy of tooth 46 (Dr Bakarčić, Dental clinic Rident).

Fig. 20
The final photo. The patient looks less like a young girl and more like a young woman.

A ceramic veneer was placed on tooth 22. Tooth 46 was successfully endodontically treated (Fig. 19).

The final image shows that the satisfied patient no longer looks like a girl, but rather like an adult young woman (Fig. 20).

Conclusion

It is well known that dental implant placement should wait until skeletal growth is completed. In the dental office, the most common method of establishing the growth phase is by hand X-ray. The disappearance of the ulnar and radial epiphysis markings is one of the most reliable signs of completed skeletal growth. However, there will be some residual growth, especially vertical, of the dentoalveolar process, which is critical in oral implantology. Usually it will be less than 1 mm, but in approximately 20 per cent of the population it will amount to an average of 1.6 mm [8]. It is therefore advisable to postpone dental implant placement, especially in the aesthetic zone, even if the completed growth has been radiologically established.

A defect code of H.1.i according to the Cologne Classification of Alveolar Ridge Defects (CCARD) had been diagnosed [9]. The abbreviations mean: H1 – "small defect up to 4 mm"; i – "inside the ridge contour". In this case, it is possible to prepare the implant bed using bone expansion as a sole treatment adjunct if the oral and vestibular bone lamellae are sufficiently flexible.

Where the dimension of the alveolar ridge is sufficient for implant placement in the correct prosthetic axis, but a lack of volume threatens the aesthetic outcome, an elegant solution is to reinforce it by inserting a free connective-tissue graft using the tunnelling technique. Flapless implant insertion using the tunnel reconstruction technique minimizes postoperative alveolar-ridge shrinkage and prevents scars [10].

If the implant is placed correctly in the 3D comfort zone and the soft-tissue volume is sufficient, it is possible to reduce the number of visits and the financial burden on the patient. ■

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Contact address

Dr Dr Snježana Pohl
Oral surgeon, EDA Expert for Implantology,
EDA Expert for Periodontology
Dental clinic Rident
Franje Čandeka 39
51000 Rijeka
Croatia
Phone: +385 51 648900
snjezana.pohl@rident.hr