Single-tooth replacement with ceramic implants

A case series

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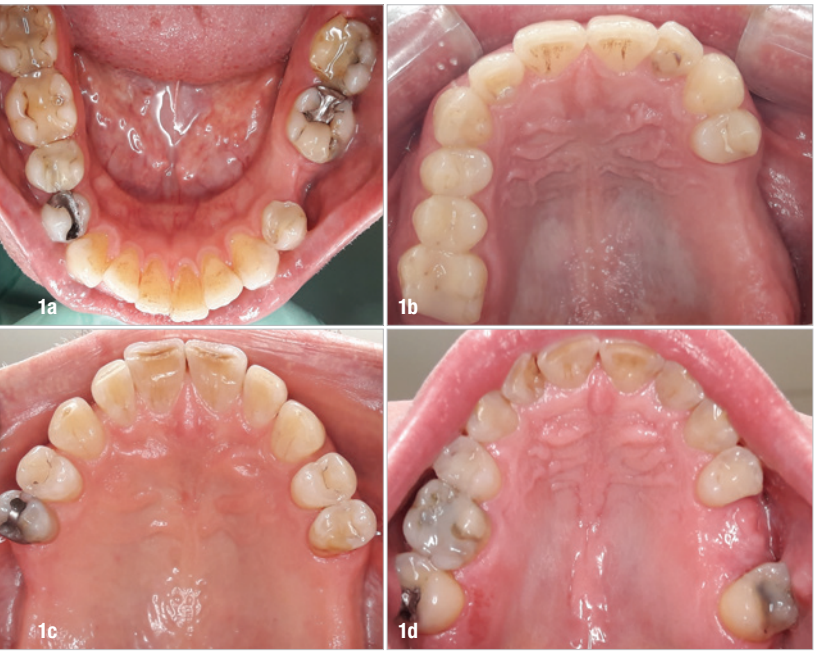


Figs. 1a–d: Pre-op situation in all four patients. Case 1 **(a)**. Case 2 **(b)**. Case 3 **(c)**. Case 4 **(d)**.

Introduction

Dental implants have helped to improve quality of life for our patients. The material of choice for implants remains Type IV titanium, whose mechanical and biological properties have been proved.[1] Yet, this material is not exempt from complications. Firstly, these metallic implants show aesthetic limitations when used in the anterior region, especially in patients with a thin gingival biotype. Examples are the possible appearance of a metallic margin in case of gingival recession and a greyish discoloration due to translucency of the peri-implant mucosa.[2,3] Secondly, studies have reported immunological reactions to titanium particles, leading to biological complications.[4] Others have demonstrated allergic reactions to titanium, reporting a prevalence of 0.6%.[5] Thirdly, it must be taken into account that the number of patients demanding metal-free implants has been increasing during recent years. For these reasons, non-metallic alternatives to titanium have emerged. The first ceramic implants arrived on the market more than 40 years ago.[6] They were made of alumina, a material prone to fracture when loaded unfavourably, and so they are no longer available on the market.[7] More recently, yttrium tetragonal zirconia polycrystal (Y-TZP) became the material of choice for the manufacture of ceramic implants. It is characterised by a high resistance to fracture, a low modulus of elasticity, a low affinity to plaque and high biocompatibility.[8,9] In this series of four cases, the CERALOG system (BioHorizons Camlog) was used. CERALOG implants are manufactured from Y-TZP.[10] The CERALOG system provides all the necessary elements to permit retention of any type of prosthesis upon these implants, ranging from single crowns to a full-arch restoration. In this case series, the treatment indication was single-tooth implants.

Table 1: Patients' data.

	Sex	Age (years)	Health status	Smoking status	Periodontal health	Diastema location
Case 1	Male	52	ASA I	No	Healthy	#35
Case 2	Male	43	ASA I	No	Healthy	#25 & 26
Case 3	Male	57	ASA I	No	Healthy	#16 & 26
Case 4	Male	61	ASA I	No	Healthy	#26

Table 2: Implant specifications.

	Position	Implant diameter	Implant length	L-PRF	Insertion torque
Case 1	#35	4 mm	12 mm	No	35 Ncm
Case 2	#25	4 mm	12 mm	No	30 Ncm
	#26	4 mm	8 mm	No	25 Ncm
Case 3	#16	4 mm	8 mm	Yes	25 Ncm
	#26	4 mm	10 mm	Yes	30 Ncm
Case 4	#26	4 mm	10 mm	Yes	30 Ncm

Case series report

Four patients were selected for this case series (Table 1). All of them wanted or needed replacement of one or two teeth with ceramic dental implants. All the patients were in good general health.

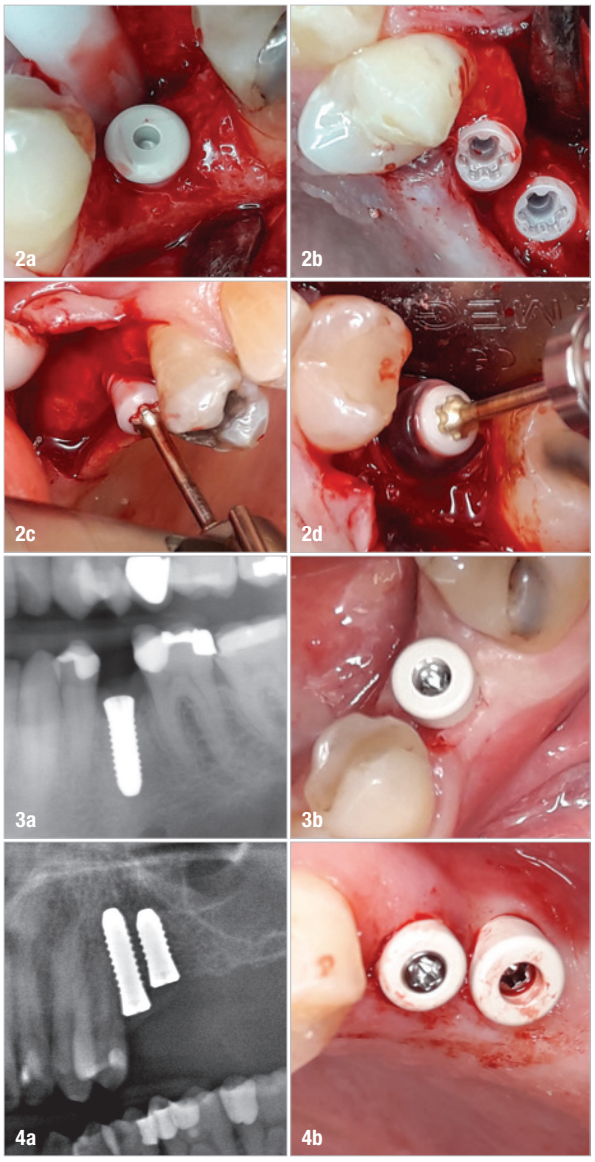
Examination

In all cases, the tooth or teeth to be replaced had been extracted at least one year before the dental implant surgery. In none of these cases was socket preservation or ridge preservation performed at the time of extraction. Moreover, all the patients had good oral hygiene. In all but one patient, radiographic analysis was performed by CBCT, supplemented with subsequent digital implant positioning (SICAT and Sidexis, both Dentsply Sirona; Fig. 1).

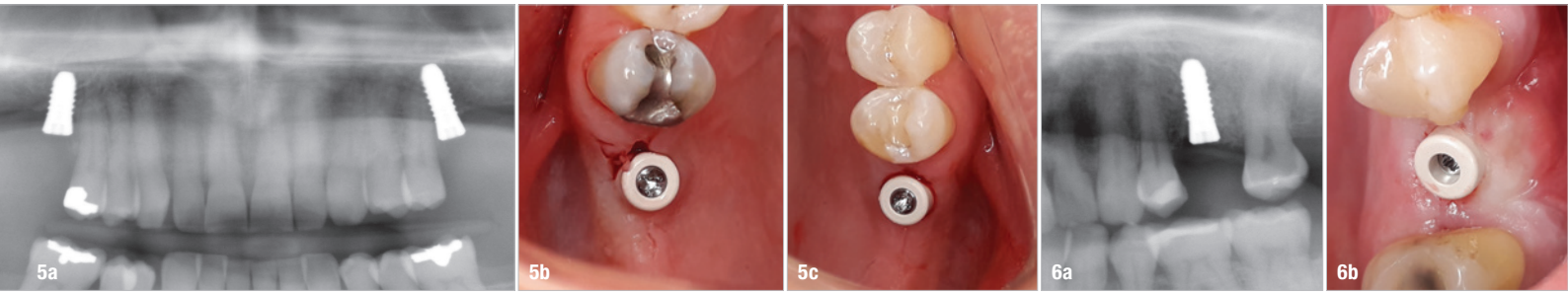
Surgery

Two-stage surgery was performed for all six implants. All surgeries were performed without sedation or preoperative systemic antibiotics. In two of the four cases, leucocyte- and platelet-rich fibrin (L-PRF) was used during the intervention (IntraSpin, BioHorizons; Table 2). In all cases, the exact CERALOG pre-tapping (maximum: 15 rpm) and drilling protocols (maximum drilling speed: 550–800 rpm) were used. All the implants were placed manually to a maximum torque of 35 Ncm. After the insertion of the implant, a PEEK cover screw was inserted into the implant (Fig. 2). The soft tissue was sutured tightly with an atraumatic resorbable suture material. No postoperative complications were reported. The patients were asked to rinse with chlorhexidine twice a day for one week postoperatively (PERIO-AID, 0.05%, DENTAID). A healing time of three months in the lower jaw and five months in the upper jaw was respected.

After three months (Case 1) and five months (Cases 2, 3 & 4), the second-stage surgery was performed under local anaesthesia. Healing abutments (PEEK material with titanium screw) were placed to a maximum force of 15 Ncm (Figs. 3–6). All the implants showed excellent stability (measured using the Periotest, Medizintechnik Gulden) and were completely osseointegrated. Radiographic examination confirmed the latter findings.



Figs. 2a–d: PEEK cover screws inserted into the implants. Case 1 **(a)**. Case 2 **(b)**. Case 3 **(c)**. Case 4 **(d)**. **Figs. 3a & b:** Radiograph after three months **(a)** and healing abutment in place (**b**; Case 1). **Figs. 4a & b:** Radiograph after five months **(a)** and healing abutments in place (**b**; Case 2).



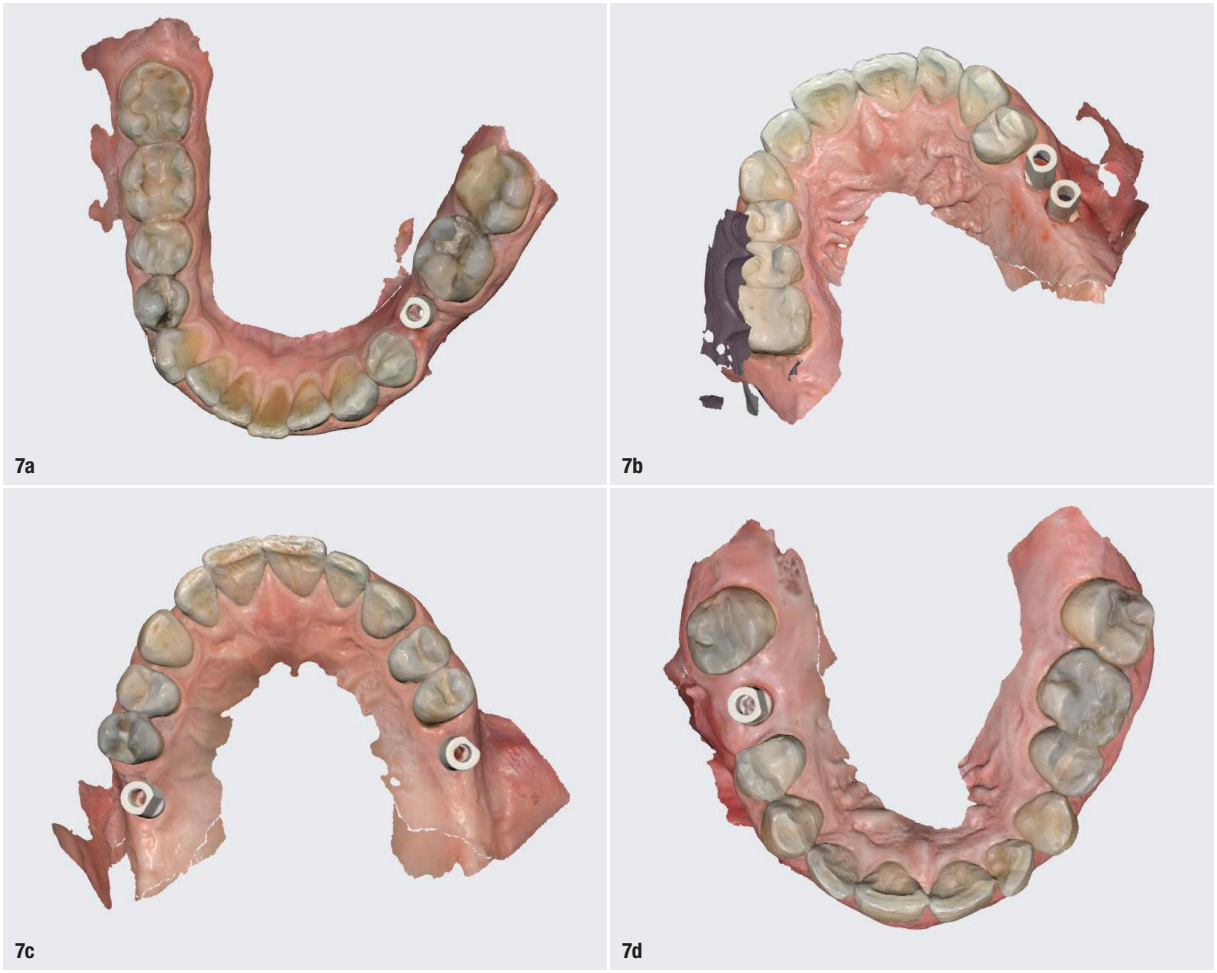
Figs. 5a–c: Radiograph after five months **(a)** and healing abutments in place (**b & c**; Case 3). **Figs. 6a & b:** Radiograph after five months **(a)** and healing abutment in place (**b**; Case 4).

Digital intra-oral scanning

One week after the second-stage surgery, the intra-oral scanning was performed using a Medit i500 scanner (Medit) following the scanning protocol prescribed by the company (Fig. 7). After the removal of the healing abutments, CERALOG scan bodies (PEEK–titanium alloy screw) were inserted into the implants. After the scanning procedure, the original healing abutments were reinserted. Shade determination was digitally carried out with a Rayplicker (Borea). For the planning of the prosthetic restoration, polyphenylsulphone selection abutments were used. All the crowns were ordered digitally from the same dental laboratory. For all the crowns, a ceramic material was selected.

Crown installation

On average, two weeks after the scanning procedure, the crowns were available for placement. PEKK abutments were used. All the crowns were prepared as screw-retained superstructures. Since the four patients strictly



Figs. 7a–d: Digital intra-oral scans after the second-stage surgery. Case 1 **(a)**. Case 2 **(b)**. Case 3 **(c)**. Case 4 **(d)**.

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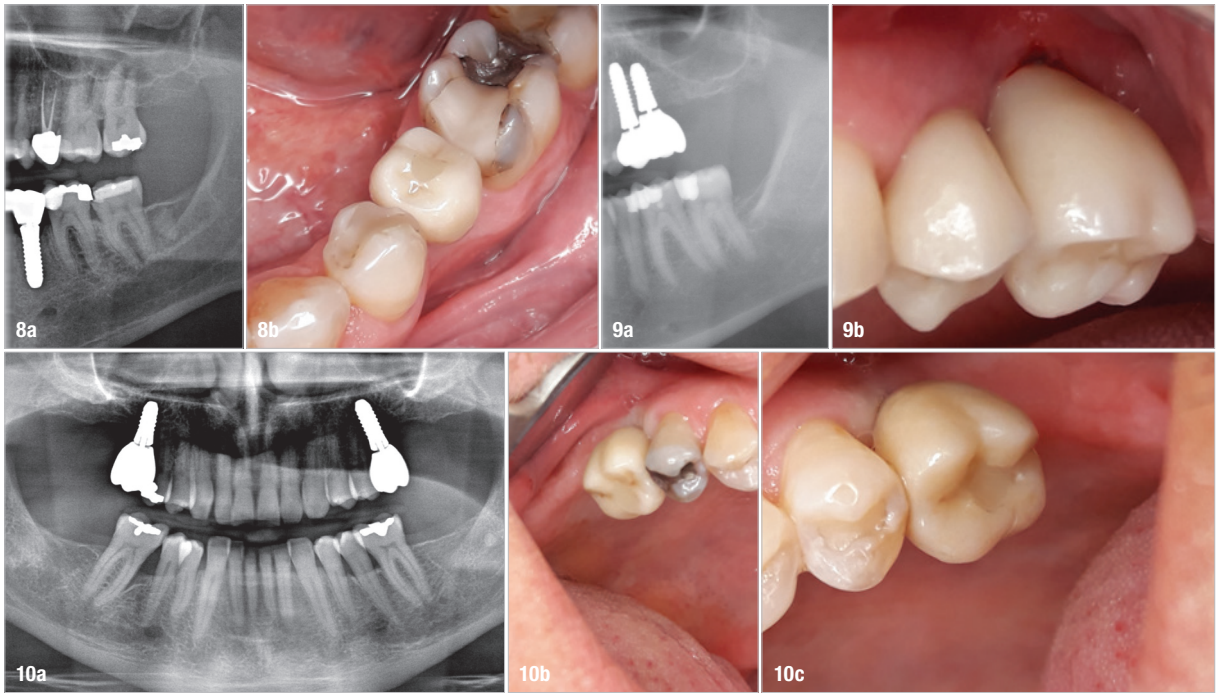
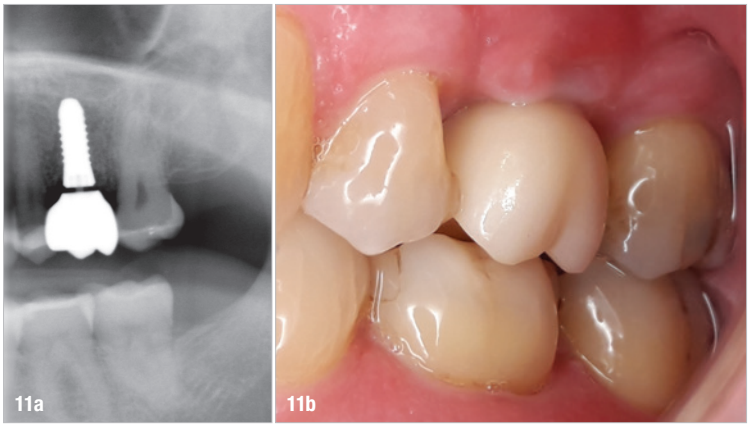


Figs. 8a & b: Final control radiograph of the implant position **(a)** and final intra-oral situation for Case 1 **(b)**. **Figs. 9a & b:** Final control radiograph of the implant position **(a)** and final intra-oral situation for Case 2 **(b)**. **Figs. 10a–c:** Final control radiograph of the implant position **(a)** and final intra-oral situation for Case 3 **(b & c)**.

wished for a bio-holistic approach, the six titanium abutment screws were replaced with six gold abutment screws (Holisticor screws). These gold screws were tightened to a maximum torque of 15 Ncm. When titanium abutment screws are used, a maximum toque of 25 Ncm should be applied. As recommended by the company,



Figs. 11a & b: Final control radiograph of the implant position **(a)** and final intra-oral situation for Case 4 **(b)**.

all the screws were retightened to the corresponding torque (15 Ncm) after at least 5 minutes. The screws were protected with PTFE tape, and the remaining screw openings were filled with a composite material of the same colour as the zirconia crown. The occlusion was checked and adjusted where necessary (occlusal concepts included no guidance on the implant-retained restorations and very light intercuspal contact as verified with occluding paper). Oral hygiene instructions were given, focused on interdental cleaning with interdental brushes. A final control radiograph was taken. The PEKK abutment is not radiopaque, and therefore the distance between the implant and crown can easily be determined in the radiograph: the abutment is correctly positioned in the implant when the gap between the implant shoulder surface and the lower edge of the crown measures 0.55 mm in the radiograph (Figs. 8–11).

Conclusion

All the patients were happy with the results of the therapy: the functional and aesthetic outcome was satisfying. The only remark was the long duration of the complete therapy for the upper jaw cases. Owing to the extended osseointegration period of five months, the complete therapy took more than six months. From the practitioner's point of view, there was no major difference in comparison with the use of titanium implants, besides the following of the strict guidelines from the manufacturer. CERALOG implants seem to be an adequate and stable alternative to titanium implants in the replacement of lateral teeth in the upper and lower jaws.

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Literature

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