A New Custom-Made Abutment for Dental Implants: A Technical Note

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The restoration of four missing maxillary incisors with implants and custom-made abutments is described. Acetal was used to fabricate the custom-made abutments, instead of the conventional metals. This material is resistant to wear, and it is biocompatible and white in color. Acetal meets esthetic requirements, particularly when restoring the anterior region of the dental arches. The white post does not give a grayish appearance to the surrounding soft tissues, and the possible gingival recession around the post will not compromise esthetics. The presented case report indicates excellent esthetic and functional results.
(Int J Oral Maxillofac Implants 1995;10:604–608)

Key words: acetal, custom-made abutment, implant abutment

The use of osseointegrated implants to restore partially edentulous patients involves the employment of prosthetic components that were originally designed for the treatment of completely edentulous patients in whom esthetic requirements may be less critical. Application of the same components for the treatment of partial edentulism, especially in the anterior region, does not always provide acceptable esthetic results because of the lack of versatility. To overcome this shortcoming, abutments (such as the UCLA abutment[1]) that allow more esthetically satisfying castings to be fabricated are now available. By means of a wax pattern and fusion of the castable part, the inclination, form, and implant-post emergence can be varied at will using the UCLA abutment.

Recently, the use of acetal (Dental D, Quattro Ti Divisione Tecnopolimeri, Milan, Italy) has been proposed for the fabrication of these abutments[2] to avoid a grayish appearance of the overlying gingiva resulting from the transmucosal path of the abutment. Moreover, gingival recession over time would not expose any metal component of the abutment. Acetal, or polyoxymethylene, is a highly crystalline thermoplastic polymer that has a unique composition, and it can be used in applications where dimensional stability is important, even when the acetalic part is under continuous stress. The strength, stiffness, toughness, and resistance to fatigue under repeated stress are features of the material that are also predictable over a wide range of temperatures for long periods. Acetals are not hygroscopic and they resist a wide range of solvents. They remain dimensionally stable in harsh environments. These features make acetals ideal for use as metal replacements. In fact, designers now consider acetal instead of metals for many applications.[3] In Italy they have been widely used for the fabrication of orthodontic appliances, removable partial prostheses, and abutment posts.[4–7] An important feature of the acetal post is its white color. This can be exploited in serving as support for a ceramic complete crown. In addition to esthetic advantages, the elasticity and resistance of the material may be suitable for absorbing forces that would otherwise be exerted on an abutment fastening screw or on an implant. Following clinical trials initiated on single implants in 1992, which resulted in excellent soft-tissue modeling around the acetal abutments

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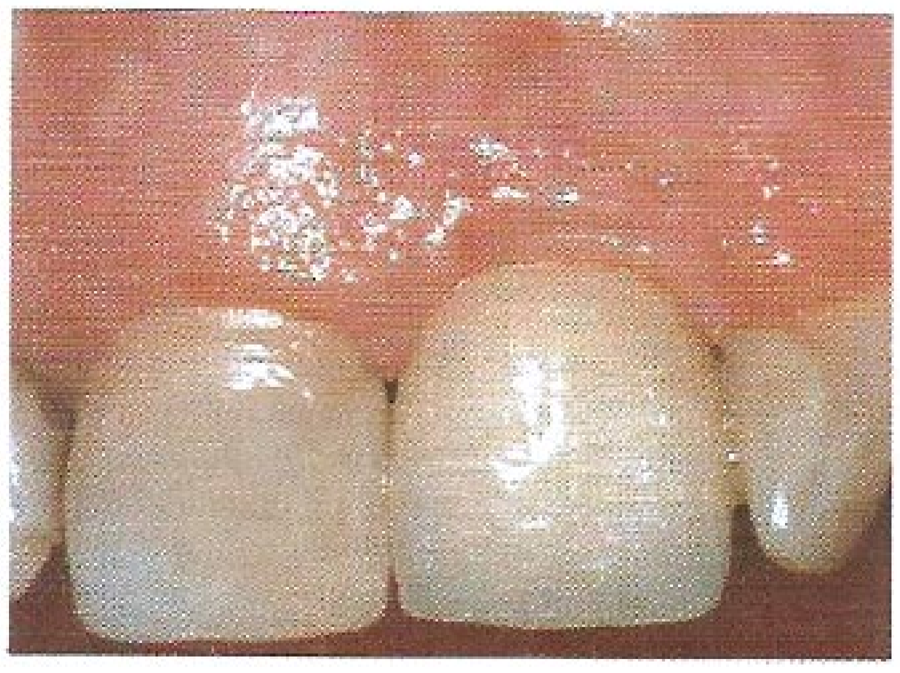

Fig 1a Clinical view of a porcelain complete crown restoring a missing maxillary left central incisor after 3 years of observation. The crown is supported by an acetalic implant abutment.

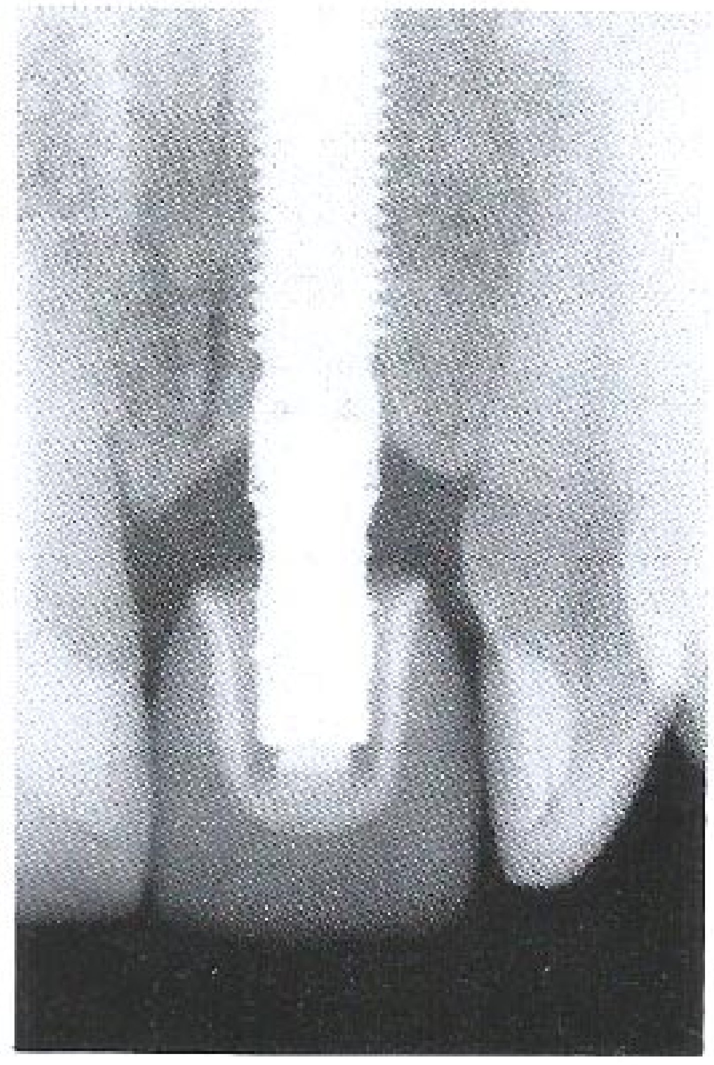

Fig 1b Radiograph of maxillary left central incisor area taken 3 years following abutment connection. The acetalic part of abutment is radiotransparent.

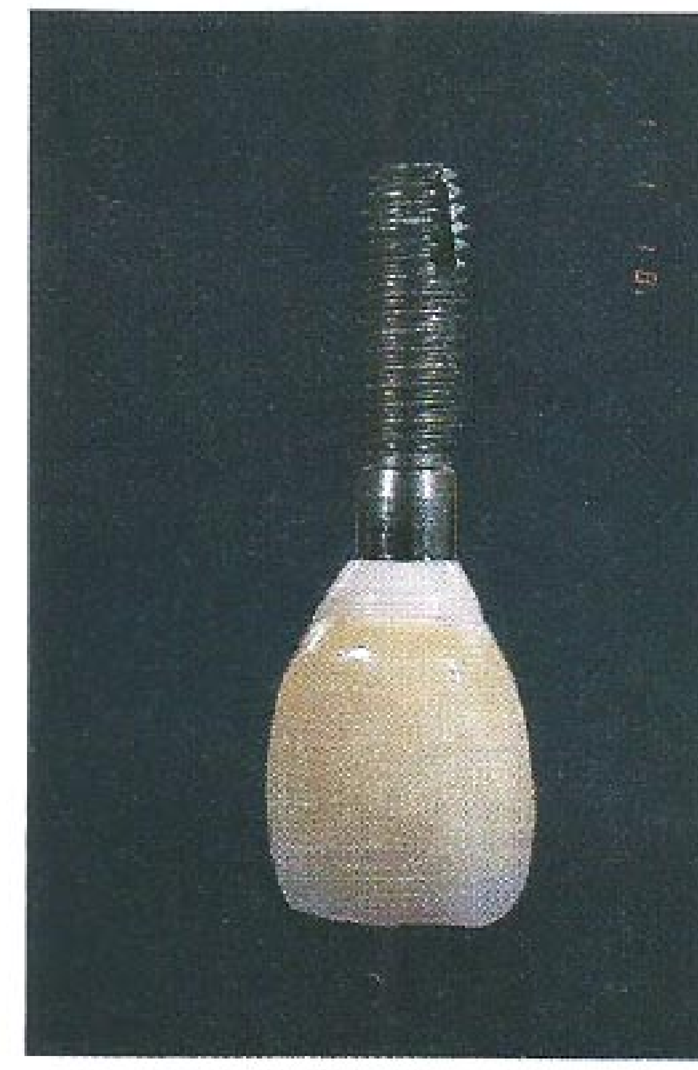

Fig 1c Crown and abutment connected to an implant before clinical use.

(Figs 1a to 1c), the technique has now been applied to more extensive prosthetic implant restorations involving multiple implant posts.

Patient Presentation

A female patient in her forties wore a removable partial prosthesis replacing the four maxillary incisors. After radiographic analysis and a wax diagnostic setup, an acrylic-resin template was fabricated for the placement of four commercially pure titanium implants, 3.75 mm in diameter and 10 mm in length (SVP10, Spectra System, Dentsply, Encino, CA), in the edentulous area. Before the cover screws were placed, transfer posts were inserted (Fig 2) and a standard impression was made, as described by Hoewald.[8] The impression was poured to obtain a position cast of the implant analogs, on which four UCLA-type abutments (KV, Vega, Padua, Italy) were fastened. The castable part of the abutments was reduced with the aid of a parallelometer and enriched with adhesive microretentions.

Fusion with gold alloy provided the metal core for the abutments (Fig 3) and a pattern was waxed with the aid of a silicone template made from the wax diagnostic setup. The template permits the establishment of the dimensions, direction, and form of the abutments, as well as calculation of the space necessary for the fabrication of the final prosthesis. During waxing, the level at which the shoulder should be profiled is established. In the case of single implants

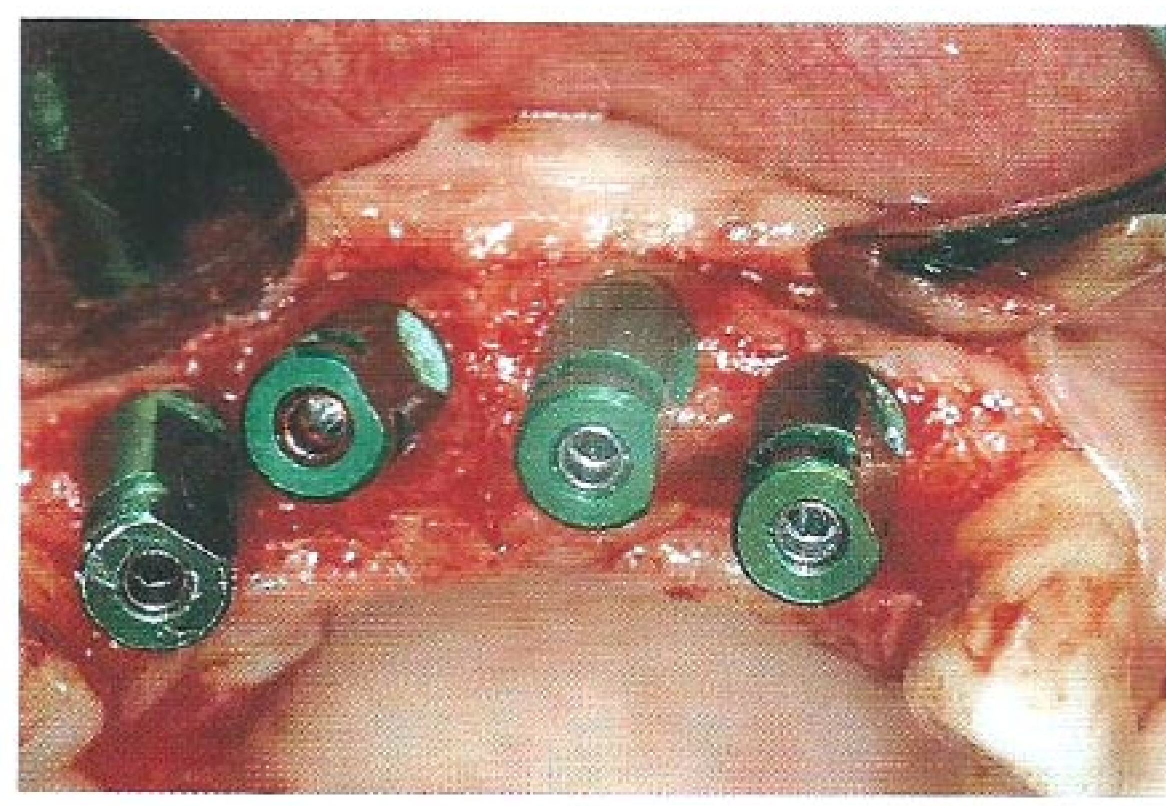

Fig 2 Transfer posts connected to the implants for the open-flap impression at stage 1 surgery.

for single teeth, the shoulder level can be indicated by the cementoenamel junction of the contiguous teeth, but in an extended restoration the shoulder is modeled on an empirical basis. This can be modified, however, using rotary instruments in situ once the soft tissues around the abutments have healed.

After the patterns were waxed, the castings were put in a muffle for the injection of the acetal. Acetal is supplied in bars and is processed by thermoplastic fusion and injection molding. The abutments were then removed from the muffle (Fig 4) and polished, and their fit was checked on an implant analog. The resulting abutments were then ready to be used in

Fig 3 *(Left)* Metal cores of the abutments after casting. The castable part of each abutment was trimmed and enriched with retention.

Fig 4 *(Right)* Abutments removed from the flask after acetal injection.

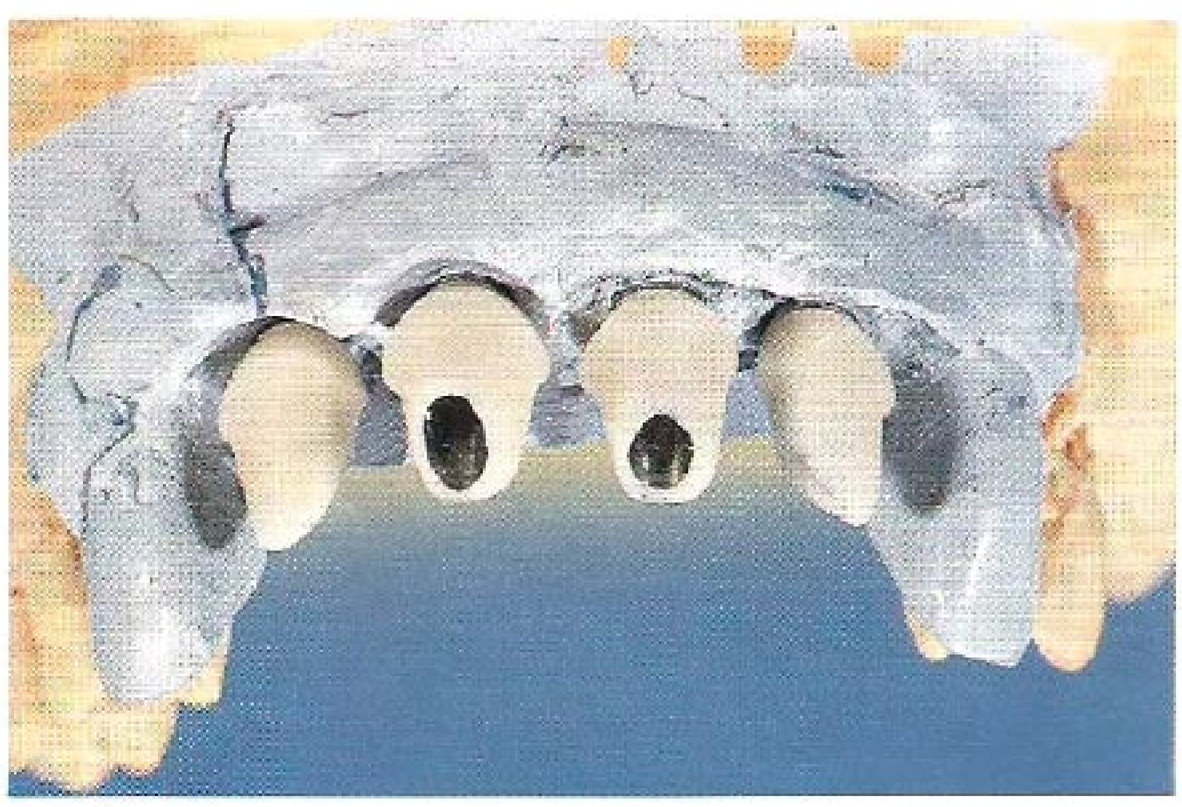

Fig 5 Final abutments on the model.

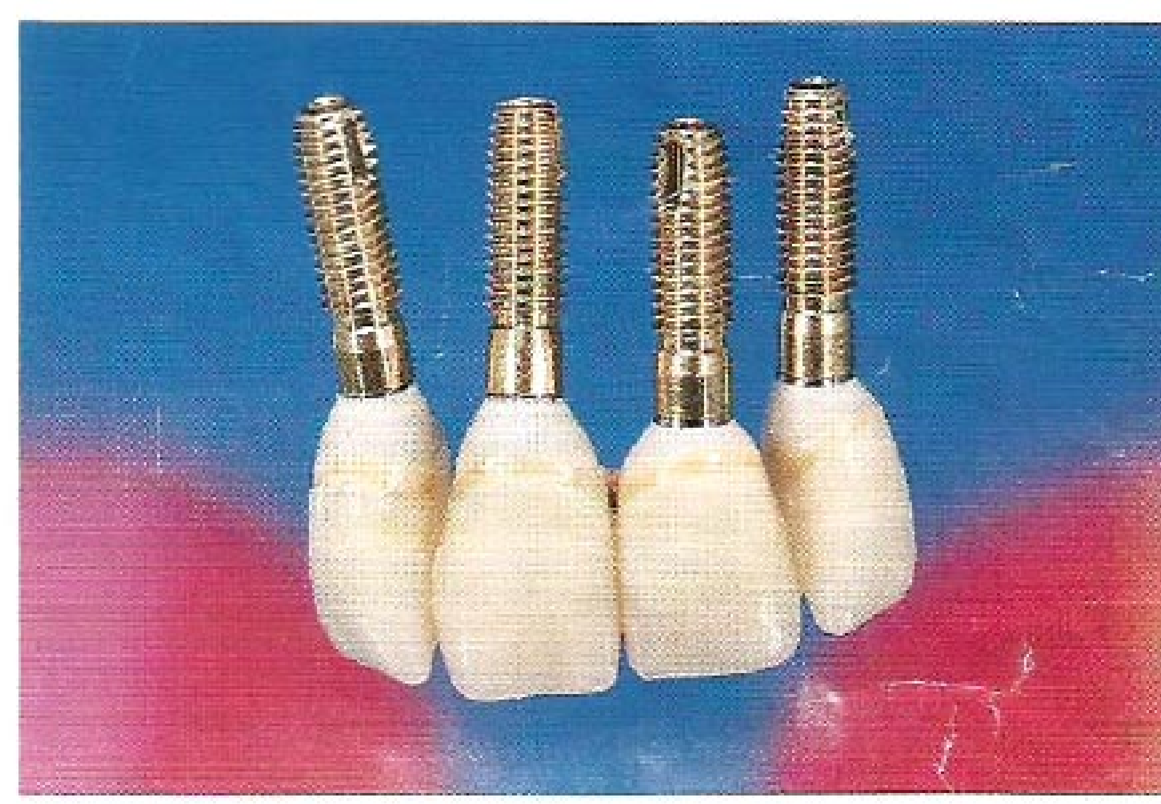

Fig 6 Temporary crowns and abutments connected to implant analogs.

Fig 7 Re-entry and abutment connection at stage 2 surgery.

stage 2 surgery to guide the healing of the soft tissues around the abutments themselves, rather than around standard healing screws, whose emergence is often not compatible with a good esthetic result. This results in less soft tissue manipulation during the various steps of the prosthetic treatment. After abutment fabrication (Fig 5), a temporary prosthesis was prepared (Fig 6).

Six months after stage 1 surgery, the implants were exposed, the abutments connected, and the screw holes closed with a photopolymerizable cement (Fig 7). The temporary acrylic-resin prosthesis was seated with temporary cement and the excess carefully removed. A gingivoplasty was performed to

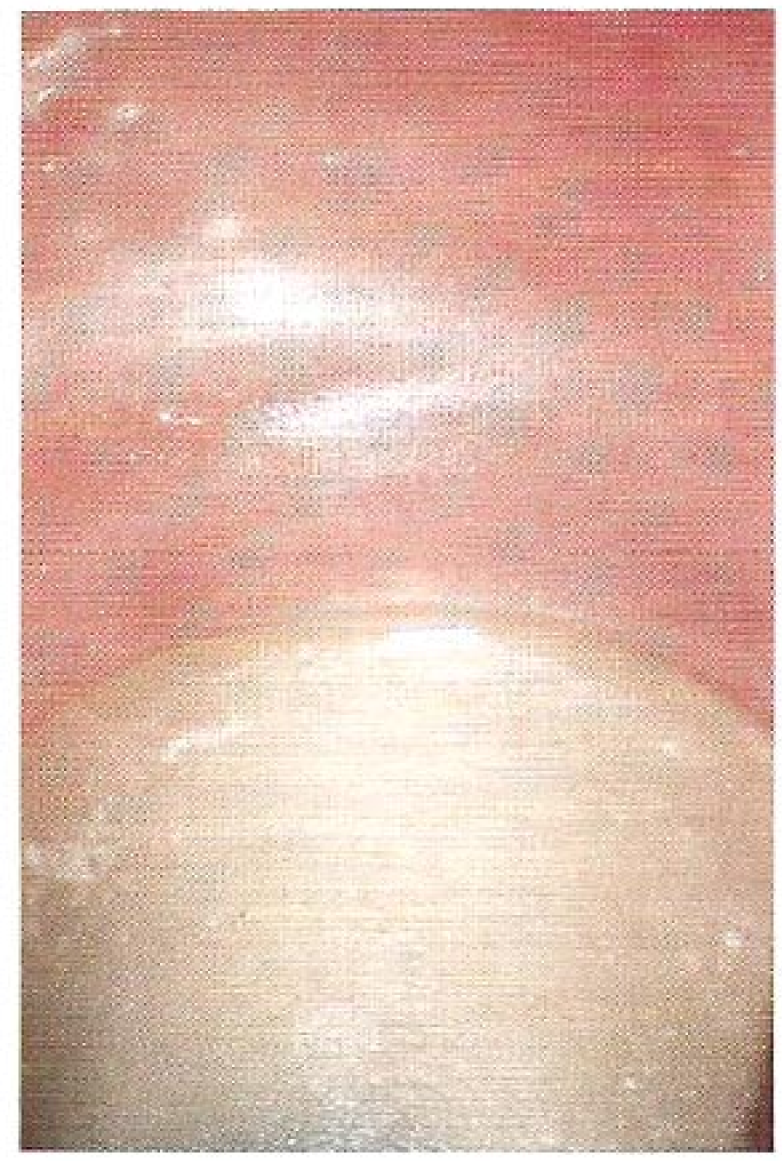

Fig 8a *(Above)* Gingival contour 12 weeks following abutment connection. At this stage, the shoulders have been redefined and the final impression made.

Fig 8b *(Right)* Detail of the gingival contour. (Original magnification × 25.)

ensure optimal soft tissue contouring around the prosthetic elements. Twelve weeks later, the soft tissues had healed well around the implant posts (Figs 8a and 8b). The abutments were slightly modified to redefine the shoulders and the final impression was made. The ceramometal restoration was then fabricated and fixed with temporary cement so that it could be removed for future evaluation, because in our experience with this type of abutment, the screws tend to become loose (Fig 9).

Discussion

Numerous in vitro and in vivo studies have investigated the response of soft tissue components on a variety of implant abutments. Titanium[9] and vitallium[10,11] have been reported to be conducive to a desmosomal type of epithelial cell attachment, as has also been shown with epoxy-methylmethacrylic resin,[12] polystyrene,[13] apatite,[13] hydroxyapatite,[14] monocrystalline sapphire,[15] and porcelain.[16] While in vitro and controlled experimental investigations using acetal in the oral mucosa are as yet lacking, data are available on the use of acetal for the fabrication of cardiac valves[17] and orthopedic implants.[18] Animal studies have indicated that acetal is biocompatible.[19] The available data on acetal indicate that this material can be used for the preparation of prosthetic implant components for obtaining good functional and esthetic results. A disadvantage of the material is its radiotransparency, which results in radiographs that fail to show the outline of the abutment in its entirety (see Fig 1b). Furthermore, the possibility of abutment fatigue fracture cannot be excluded because no studies on the durability of acetal in the oral environment are yet available.

Fig 9 Final restoration 6 months after cementation, showing good gingival status.

Within the limits of this study, the reported clinical results provide sufficient information to encourage long-term experimentation before the use of acetal can be considered routine.

Acknowledgment

The authors thank Roberto Abbundo, DDS, for his critical assistance in the prosthodontic procedures.

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Résumé

Un nouveau pilier individuel pour implants dentaires: Note technique

La restauration de quatre incisives maxillaires supérieures à l'aide d'implants et de piliers individuels est décrite dans ce rapport. Une résine acétallique fut utilisée en vue de la fabrication des piliers au lieu des métaux conventionels. Ce matériau est résistant à l'abrasion, biocompatible, et de couleur blanche. La résine acétallique satisfait aux impératifs esthétiques, en particulier lors de la restauration à la région antérieure. Le pilier blanc ne crée pas de grisaillement au niveau des tissus mous avoisinants, et la récession gingivale autour des piliers toujours possible, ne compromettra pas l'esthétique. Le cas présenté ici démontre à la fois d'excellent résultats esthétiques et fonctionnels.

Zusammenfassung

Ein neues, individuell angefertigtes Abutment für zahnärztliche Implantate: Ein technischer Bericht

Der vorliegende Bericht beschreibt die Rekonstruktion von vier fehlenden Oberkieferschneidezähnen mit Hilfe von Implantaten und individuell angefertigten Abutments. Anstatt von konventionellem Metall wurde Acetal zur Herstellung der individuell angefertigten Abutments verwendet. Dieses Material ist bruchfest, biokompatibel und hat eine weise Farbe. Acetal erfüllt die ästhetischen Anforderungen, besonders bei der prothetischen Versorgung im Frontzahnbereich. Der weise Aufbau läßt das umgebende Weichgewebe nicht grau erscheinen, und mögliche Rezessionen werden keine ästhetischen Einbußen hervorrufen. Der vorgestellte Fallbericht zeigt ein ausgezeichnetes Behandlungsergebnis in sowohl ästhetischer als auch funktioneller Hinsicht.

Resumen

Nuevo pilar para implantes dentales hecho a la medida: Apunte técnico

Se describe la restauración de cuatro incisivos maxilares ausentes, con implantes y pilares hechos a la medida. Se utilizó el acetal para fabricar tales pilares, en lugar de metales convencionales. Este material es resistente al desgaste, biocompatible y de color blanco. El acetal llena los requisitos estéticos, particularmente al restaurar la región anterior de los arcos dentales. El poste blanco no da la apariencia grisácea a los tejidos blandos circundantes, y la posible retracción gingival alrededor del poste no compromete la estética. Este reporte de caso presenta los excelentes resultados funcionales y estéticos.