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Conical retention with antirotational features (Acuris abutment) has been recently proposed for restorations of healed single implants. The conometric abutments use the retentive force of the coping-abutment system to retain the prosthetic crown without the use of cement or screws. This retentive force must be overcome to obtain detachment of the relined provisional crown in immediate restorations. The present article describes the use of digital scanning technology to virtually plan computer-guided implant placement and restoration with conical indexed abutments in postextraction sites. Importing the scan data of both matrix and patrix abutments that are seated on the definitive cast into the computer-aided design software provides a workflow to preoperatively mill a crown that perfectly fits the abutment into the postextraction site. This technique simplifies the provisional crown relining onto the conometric indexed abutment and reduces the intraoperative time. Int J Periodontics Restorative Dent 2021;41:135–140. doi: 10.11607/prd.4955

The use of the conometric concept, intended as a tapered cone design to retain a coping on the relative abutment by surface friction, has been successfully proposed to provide fixed retention between implants and dental prostheses without the need for cement or screws.1–4 Additional reported advantages of the cone-in-cone connection are simple maintenance, a deep emergence profile without the risk of residual subgingival cement, and cost-effective prefabricated components.5,6 Recently, Degidi et al discussed the use of a new conical indexed abutment (Acuris abutment, Dentsply Sirona) for the rehabilitation of single implants.7 This conical indexed abutment was designed with antirotational features to overcome the possible disengagement of the conical connection in single-unit restorations due to rotational forces. Detachment of the crown may also occur when the coping is not fully seated on the abutment. Therefore, when an immediate postextraction restoration of a single implant is planned using the conometric indexed system, careful 3D planning of the implant position is needed to avoid interference of the coping shoulder margin with the alveolar socket and to fully engage the coping on the abutment. Andersson et al suggested, for aesthetic purposes, that the crown-

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abutment interface should be even deeper than 2 mm to achieve a better crown emergence profile. Albiero et al published a technique to implement computer-guided implant planning using digital scanning technology for an immediate rehabilitation supported by conometric abutments. This report describes a CAD/CAM workflow using the definitive cast scan data to design and mill a provisional crown for immediate single-implant restorations supported by conical indexed abutments.

Case Report

A 38-year-old Caucasian woman with a recent history of facial trauma was referred from another office with the chief complaint of root fracture of the maxillary right central incisor. Intraoral examination confirmed severe tooth mobility (Fig 1), and the CBCT scan showed an oblique root fracture. Treatment with computer-guided implant placement and immediate provisionalization was planned. Maxillary and mandibular impressions were taken, and dental casts were mounted on a semi-adjustable articulator. CBCT images were imported into the planning software (Simplant Pro version 18.5, Dentsply Sirona). The 3D model of the patient’s maxilla was created using the segmentation tool of the Simplant software, and the tooth to be extracted was virtually removed. The maxillary and mandibular casts were scanned using an optical scanner (SINERGIAscan, Nobil-Metal). Then, the laboratory casts were scanned in maximal intercuspal position. The scan data of the casts were imported into the scanning software (DentalScan version 7.0, Exocad). Central incisor extraction was digitally simulated, removing the tooth to be extracted from the maxillary cast to the gingival level. The model was exported as a standard tessellation language (STL) file 1 (STL1). The virtual wax-up of the tooth was designed, and the model was exported as STL2. The Optical Scan Wizard of the Simplant software was used to import, match, and align the STL1 and STL2 files with the 3D view of the patient’s arch. An Ankylos implant (4.5-mm diameter, 11-mm length; Dentsply Sirona) and Acuris straight abutment were virtually planned according to the prosthetically driven treatment plan. This step is possible because the conometric indexed abutment and coping are available in the planning software library (Simplant library, version 5.7.0.20). The 3D position of the coping’s shoulder margin was checked (Fig 2), ensuring that the coping did not contact the alveolar bone. The surgical guide was requested from the manufacturer (Dentsply Sirona via Simplant) by transferring the planning data. An implant analog was positioned into the definitive cast using the surgical guide and Ankylos Positioning Aid (Dentsply Sirona). The planned abutment was screwed on the laboratory analog, and the coping (temporization cap, Dentsply Sirona) for the provisional restoration was positioned on the abutment (Fig 3a). The definitive cast was scanned (STL3) and imported into the CAD software (DentalCAD 2.3 Matera, Exocad; Fig 3b). A provisional crown with margins 200 µm thick, fitting the coping, was designed, and the crown margins were placed at the coping shoulder margin level. A 150-µm space between the crown and the coping was provided using the “gap width of cement” soft-
ware tool (STL4; Fig 3c). A crown in polymethyl methacrylate was milled using a five-axis dental milling machine (inLab MC X5, Dentsply Sirona) by means of the STL4 information. The crown margins were refined with a tungsten bur (H 139 EF, size 023; Komet) until a thickness of about 100 µm remained (Fig 4).

Antimicrobial prophylaxis was obtained with 2 g amoxicillin 1 hour before the procedure. After local anesthesia infiltration (mepivacaine 2% with adrenaline 1:100,000), a flapless extraction of the fractured tooth was performed. Drilling and implant placement were performed through the surgical guide. An insertion torque of 47 Ncm was registered. After guided implant placement, the planned indexed abutment (Acuris straight abutment) was connected to the implant and tightened to 25 Ncm (Fig 5). The buccal gap was filled with a grafting material (Bio-Oss Collagen, Geistlich). The coping (Acuris temporization cap) was placed on the abutment, and the connection was engaged simply by pressing it after aligning the matrix and patrix (Fig 6a). A periapical radiograph was taken to check that the temporization cap fully engaged the abutment (Fig 6b). The milled crown was relined with dual-polymerizing composite resin (combo.lign, Bredent). The restoration was removed using a dedicated clamp with plastic inserts, then trimmed and polished (Fig 7). Finally, the restoration was engaged with the abutment by pressure (Fig 8). Occlusion was checked in order to avoid centric and lateral excursion contacts. The definitive restoration was fabricated and then engaged to the abutment using an axially directed force from a dedicated fixation tool (Fig 9). Postoperative analgesic treatment...
was performed using 80 mg ketoprofen every 12 hours for 2 days. No postoperative complications were registered. The 6-month follow-up revealed stable keratinized tissues, with no modifications to their immediately postoperative appearance.

**Discussion**

Esthetic paradigms require leaving the crown margins subgingival. Some authors recommend positioning the crown margins 1 to 2 mm subgingivally, or even deeper than 2 mm, to obtain a better crown emergence profile.\(^a\) Cement-retained restorations present significantly more cement remnants, as the crown-abutment margin is located more submucosally.\(^b\) Conversely, the position of the screw hole can influence the esthetic outcomes, especially in the ante-
rior maxillary region, when using a screw-retained restoration.\textsuperscript{11} The screw-retained restorations allow predictable retrievability, unlike the cement-retained prostheses that may be damaged because of technical complications.\textsuperscript{12} Screw-retained prostheses are reported effective in terms of oral hygiene and simpler procedures, though the access hole creates a weak spot in the porcelain surface that can cause a statistically significant increase in ceramic fracture/chipping when compared with cemented prostheses.\textsuperscript{13} Biologic complications are proven to be significantly increased with cemented vs screw-retained restorations\textsuperscript{14}; the documented advantages of cemented retention lie in the compensation of improperly inclined implants, passivity, and improved occlusion control.\textsuperscript{13,14}

The conometric connection can provide a fixed retention for an implant-supported prosthesis without the use of cement or screws. Using this approach, in guided implant surgery, the crown-abutment margins can be planned deeper than 2 mm below the gingival level without the risk of leaving cement. By doing so, the deep position of the temporization cap into the alveolar socket could jeopardize the relining step (using a commercial denture tooth or a CAD/CAM crown with margins at the gingival level and a wide gap) because of the reduced crown-coping contact surfaces. This will result in failure to overcome the retentive force of the conical indexed system, detaching the conometric coping. This procedure can be performed without using an intraoral scanner and without the need for an in-house milling machine (the provisional crown is milled before the day of treatment). Moreover, by importing the virtual wax-up into the planning software, the conometric coping can be planned without having to position the screw access in the palatal cingulum region, as done for screw-retained restorations. Because of the simplified relining step and the reduced treatment time, this CAD/CAM approach to fabricating the provisional crown before the day of treatment represents the key to successfully using the conometric indexed Acuris system for immediate loading.

**Conclusions**

A rehabilitation supported by conical indexed abutments was planned to restore a single guided implant. Digital scanning technology was used to import the Acuris abutment position from the definitive cast into the CAD software. A provisional crown was designed and milled to perfectly fit the conometric coping into the alveolar socket and to obtain a favorable deep emergence profile. The proposed workflow facilitates the relining procedure when an immediate-postextraction rehabilitation of guided implants is planned using conical indexed abutments.

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References


Video Illustrations of the surgical and prosthetic steps of the presented workflow.