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Three-Dimensional Location of the Retaining Screw Axis for a Cemented Single Tooth Implant Restoration

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Abstract

Retrievability is a major concern with cemented versus screw-retained implant restorations. This article describes the use of cone beam radiography to help target and create a precise screw access opening for a loosened implant-supported single crown retained by cement to its abutment.

Historically, screw loosening has been a complication seen with some frequency in implant-supported restorations.[1-3] Although techniques and mechanical designs have been modernized to decrease these problems, the potential for screw loosening still exists, particularly with single posterior implant-supported crowns in occlusal contact.[4] The majority of crowns made for dental implants are cemented to screw-retained abutments, rather than being fabricated to be screwed directly to the implant.[5] The retrieval of a cemented implant-supported crown that becomes mobile because of screw loosening may be difficult. The protection of the integrity of the implant is foremost to the preservation of the crown. For this reason, practitioners may be reluctant to use forceful measures to unseat the crown from the abutment and may often choose to sacrifice the crown. This creates a situation whereby the crown, and potentially the abutment, must be refabricated. A more cost-effective approach is to create a confined access opening in the crown to engage the loose retaining screw, retighten it, and repair the opening. There are several references in the literature to techniques for locating such an opening, predicated on knowledge of the crown derived when it was fabricated.[6–8] From a practical standpoint, this type of information may often be lost or unknown to the practitioner by the time any complications arise. More recently, it has been suggested that information from periapical radiographs can be helpful to indicate an approximate access position.[9] This article describes a method to visualize the most accurate location to create an ideal access for an abutment retaining screw engaging a dental implant, without purview of the crown's original construction.

Because of the configuration of remaining bone, implants may not always be found in the aligned position reflected by the final anatomy of the restoration.[10] Variances in axial position of the implant versus the crown may include any direction relative to the horizontal (occlusal) plane: mesial, distal, buccal, or lingual. Such discrepancies may not be determined solely by clinical visualization or conventional 2D radiography.

Cone-beam computed tomography (CBCT) is now widely available for dental applications and provides new perspectives in diagnosis and treatment planning of dental implant patients.[11,12] CBCT can provide images in not only the traditional sagittal, coronal, and axial views, but virtually in any desired plane allowing observation of fine details of high-contrast structures. An advantage of CBCT resides in the amount of information provided by these images relative to the amount of exposure to radiation. Total cumulative exposure to any source of radiation should always be considered and only be administered when clinically indicated. High resolution CBCT systems with small fields-of-view (FOV) that can further limit radiation exposure have been developed.[13,14]

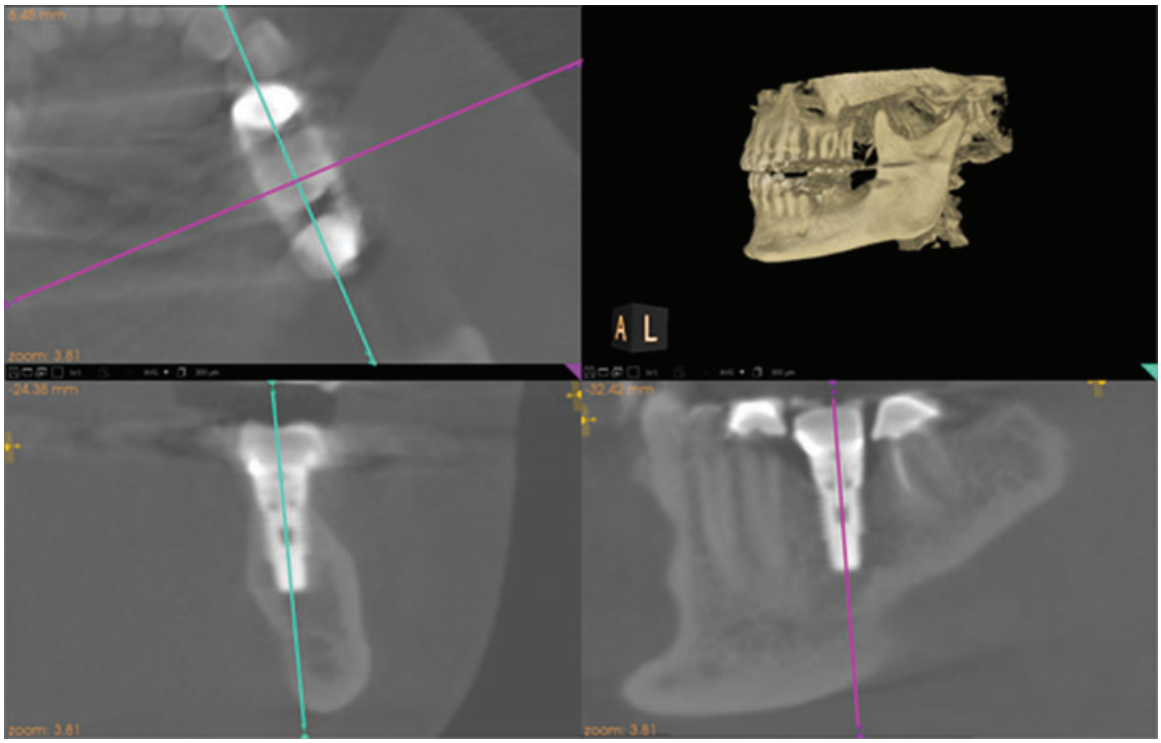

Figure 1 Tomographic images in the sagittal, frontal, and coronal planes, related to the implant axis.

Technique

The purpose of this technique is to help the clinician define where an access opening can be precisely created for an implant/abutment-supported, cemented crown if the restoration becomes mobile as a result of loosening of the retaining screw. The following procedural steps define the location of the implant/retaining screw axis relative to the cemented clinical crown in all dimensions.

(1) Determine clinically that the crown and abutment are still united by cement and that the loss of screw preload is the cause of the loose crown.
(2) Create a new, or revisit an existing, CBCT scan (Kodak 9000 3D, Carestream Health Inc., Rochester, NY) for the patient exhibiting the loose crown.
(3) Manipulate the software to demonstrate cross sectional views from the sagittal, frontal, and coronal perspectives (Fig 1). Various slice perspectives, contrasts, and optical densities may need to be reviewed to procure the clearest image.
(4) Activate linear tracers in the software for the sagittal and frontal views that concurrently intersect, using cross-reference points, with the coronal view (teal and magenta reference lines). These may also be created by transferring the images and their reference points to external editing software (i.e., Photoshop CS5, Adobe Systems Inc., San Jose, CA).
(5) Clinically appraise the location of the intersected lines from the coronal view and begin a focused entry through the crown, while considering the revealed axis of the implant, using a US No. 6 round diamond and/or carbide bur (018, Komet, Rock Hill, SC) (Fig 2).

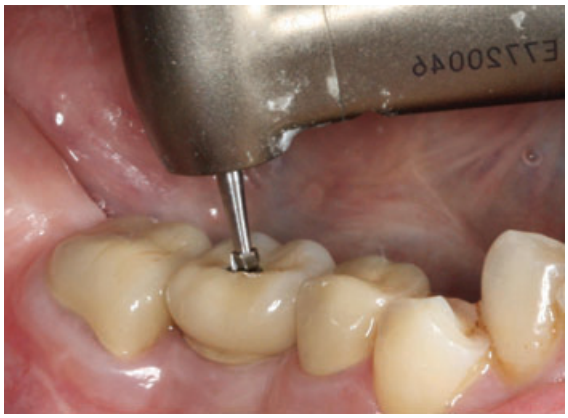

Figure 2 Creating an access through the crown coinciding with the screw location and implant axis.

In this particular case the access is located slightly distal and slightly lingual to the central anatomy of the crown (Fig 3). Keeping this aperture as small as possible helps to preserve the residual integrity of the crown and enhances the prognosis for a successful access restoration. This technique is also useful to help predict and inform the patient when a loose implant/abutment-borne cemented crown may be amenable to

Figure 3 The opening size is confined to the diameter of the screw head.

axial access and repair, or if remake of the restoration may be required. The cost/benefit of the scan and relatively low radiation dose may far outweigh the cost of new restorations or abutments if the loose screws cannot be precisely located, accessed, and retightened in this conservative fashion. In the case of a restoration supported by more than one implant, or multiple implant restorations, the original scan may be reformatted to identify the axial location of all multiple implants in a given field.

Conclusion

Use of the CBCT scan adds a further dimension of information that can be used to improve the treatment alternatives of the dental implant patient with a mobile single cemented crown caused by screw loosening.

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