Simplified Guide for Precise Implant Placement: A Technical Note

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Ideal implant placement is ultimately determined by the requirements of the final restoration. For the surgeon placing implants, proper angulation, parallelism, and spacing are critical to the final restoration. The use of a stainless-steel drill guide sleeve in an acrylic resin surgical template can make it possible to achieve optimal placement. Communication between the restoring dentist, surgeon, and laboratory technician is enhanced by this system since dowel pins fit precisely into the sleeves and determine sleeve and, ultimately, implant position. This system allows the surgeon to negotiate bony irregularities and ramping defects with ease while preparing a more concentric implant site.
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Much has been written about the success of various dental implant systems in terms of integration, patient satisfaction, and esthetics.[1–3] However, less information is available regarding proper implant placement techniques that make use of templates.[4,5] Without proper implant placement, treatment may still be deemed a failure regardless of how well the implant(s) may be integrated.[6] The final restoration guides implant placement, and such critical factors as quantity, quality, and morphology of the underlying basal alveolar bone must be taken into consideration. A properly fabricated implant template (or surgical guide) can and should be an integral step in implant placement.

A surgical guide composed of stainless-steel sleeves integrated into an acrylic resin template has been developed. The stainless-steel sleeves (GuideTech, Murray, UT) allow the laboratory (under the guidance of the restorative dentist and surgeon) to precisely locate both implant placement and the degree of parallelism desired. For the surgeon, the sleeves help to make a concentric bony osteotomy. They maintain the position and angulation of the surgical drill. Because stainless steel is not easily cut, the sleeves maintain the correct position and drill angulation throughout the entire drilling procedure. An acrylic resin template without sleeves is easily cut and distorted by sharp surgical drills, which can result in untoward changes in position and angulation. Preparation may also be made difficult by a ramping defect of underlying bone or when different bony densities deflect the drill toward the path of least resistance. The stainless-steel guide sleeves have also been used to maintain a concentric hole while drilling through implanted material, such as hydroxyapatite or Calcitite.

Materials and Methods

The guide sleeves are made of 912-gauge surgical grade stainless steel. The internal diameter is milled to accept the final drill of several implant systems within a very tight tolerance of 0.001 inches. This provides a very smooth and precise guide. The sleeves are 4 mm in height, and they include paralleling guide pins of the same diameter as the final drill of the particular implant system. The guide pins are used by the restorative dentist or laboratory techni-

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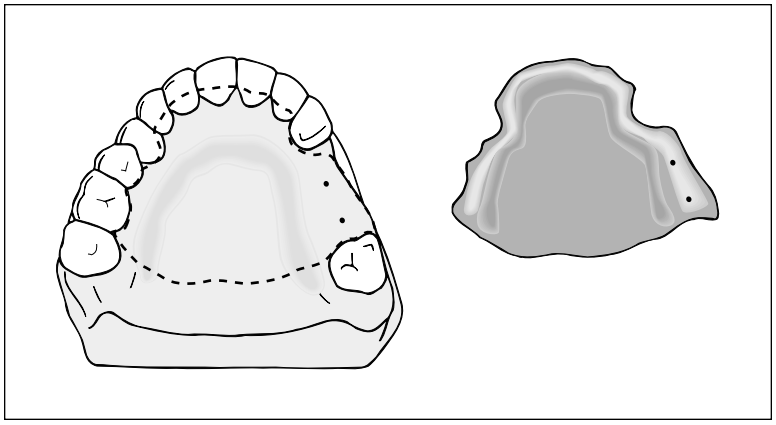

Fig 1 The positions of the implant(s) are marked on the cast. An acrylic resin template is fabricated to cover the ridge anatomy in the areas of implant placement. The template is fabricated so that it is easily removed and placed onto the cast being adapted to the remaining teeth and ridge contours. The close adaptation of the template ensures that it fits reproducibly in one position each time it is removed and replaced.

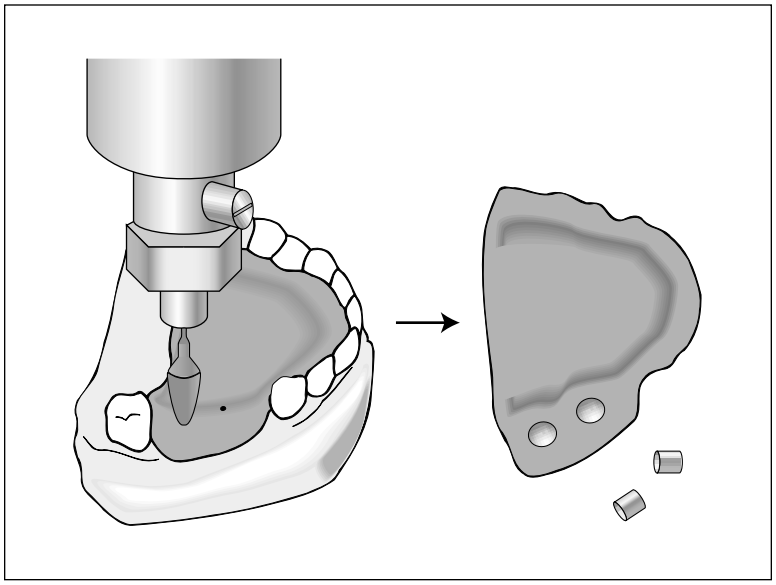

Fig 2a Holes slightly larger in diameter than the outside diameter of the stainless-steel sleeve are drilled over the pencil marks on the ridge, indicating implant location.

cian to position the guide sleeves and to determine the correct degree of parallelism.

Template Fabrication. Following a comprehensive oral and radiographic examination, a diagnostic cast and/or wax-up are completed as necessary. With this information the implant team decides where the implants are to be located. The patient's denture or partial denture is usually duplicated in clear acrylic resin using a denture duplicator, and this then serves as the surgical guide. As an alternative, a standard or traditional clear acrylic resin template can be fabricated with bases or flanges over the edentulous area to be reconstructed (Fig 1). The template is then ground to accept the stainless-steel guide sleeves (Figs 2a and 2b). The paralleling guide pins are used to axially align the sleeves to one another, and the sleeve is then bonded into position with autopolymerizing acrylic resin (Fig 3).

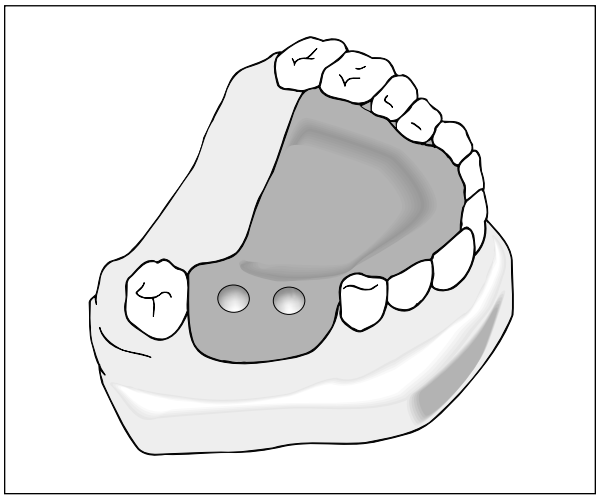

Fig 2b The stainless-steel implant sleeves are placed into the holes in the template.

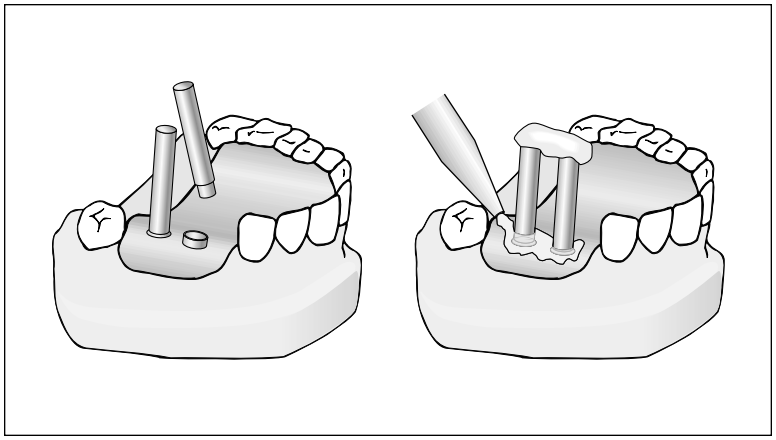

Fig 3 *(Left)* Guide pins are used to align the sleeves in the template, and autopolymerizing acrylic resin is then applied to hold the guide sleeves permanently in position in the template. As the acrylic resin around the sleeve begins to harden, the alignment dowel can be manipulated to precisely align the sleeve. *(Right)* After the resin around the sleeve(s) has hardened, the alignment dowels can be replaced to recheck the alignment. Pressure placed on the sleeves ensures that they will not loosen or be easily displaced.

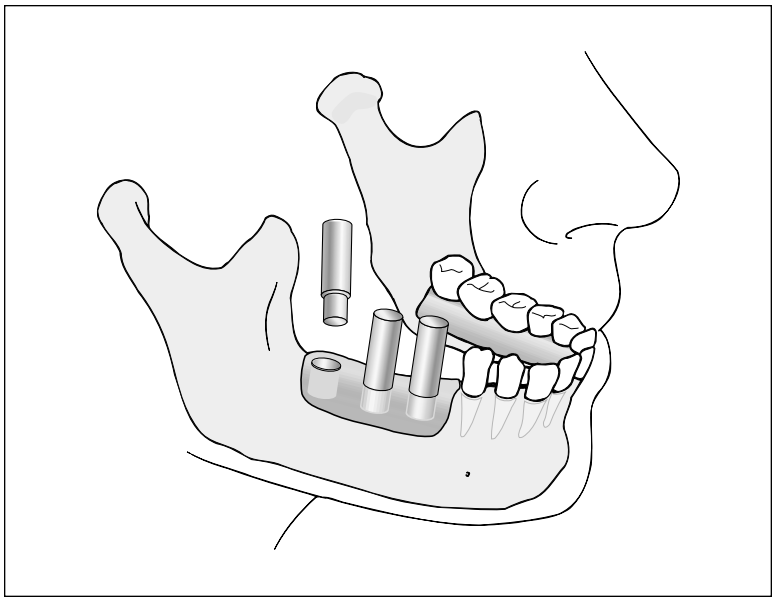

Fig 4 Illustration of the relationship of parallelism between the dowel-sleeve unit in acrylic resin and the adjacent teeth.

Surgical Techniques. Once the template is verified for accuracy and fit, the underlying alveolar mucosa may be marked with methylene blue in the flap design. The flap is raised and the underlying bone is evaluated, with consideration given to surface anatomy and sleeve placement. The template is held firmly in place, and the drilling sequence is performed through the guide sleeves, as per standard protocol for the particular implant system. Proper positioning and parallelism between the implants and adjacent teeth are assured by both the laboratory positioning dowels (Fig 4) and the low tolerance between the stainless-steel sleeve and the final surgical drill. Figures 5a to 5e depict a clinical situation that involved ramping defects in the buccal bone. The guide sleeves in a surgical template were used to align the final drill and to obtain the desired position of the implants.

Discussion

As the osseointegration concept is better understood, so must be the technical and mechanical aspects of implant surgery preparation. A one-person team can rarely succeed, and a unified implant team involving the restorative dentist, surgeon, and laboratory technician is needed to distill ideas and expertise into a well-devised implant treatment plan to maximize function and esthetics. Use of a surgical guide should be an integral part of implant surgery.

Stainless-steel guide sleeves provide confidence that implants are placed in their proper position. The particular implant template described here has been found to be useful when there is severe alveolar atrophy; where other guides may move; and in situations where the surgeon's perspective of interarch and

Figs 5a to 5e Female patient requiring three anterior endosseous implants.

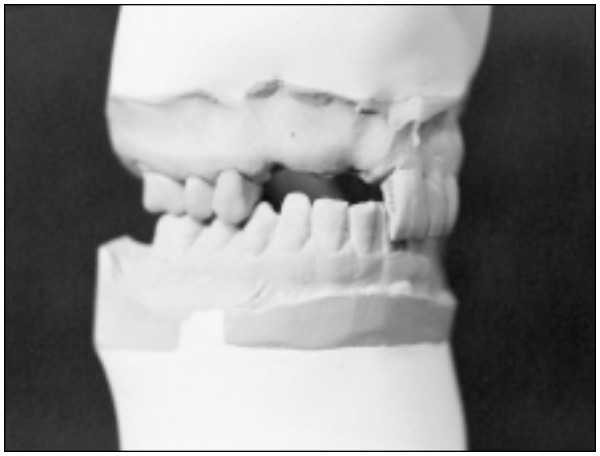

Fig 5a Mounted diagnostic casts. Note the bone irregularities and undercuts in the area of desired implant placement, making exact positioning of the preparation site difficult.

Fig 5b Surgical template in place with three surgical guide sleeves in position. Note parallelism between the teeth and dowel-sleeve unit.

Fig 5c Position of the sleeve guides within the template. These sleeves have an internal diameter designed to accept a 3.5-mm final drill with a tolerance of 0.006 inches. Sleeves are available in various diameters to accomodate multiple implant systems.

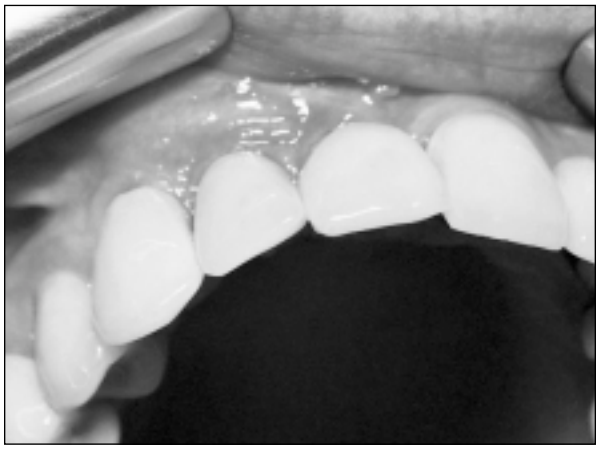

Fig 5d Emergence profile of implants.

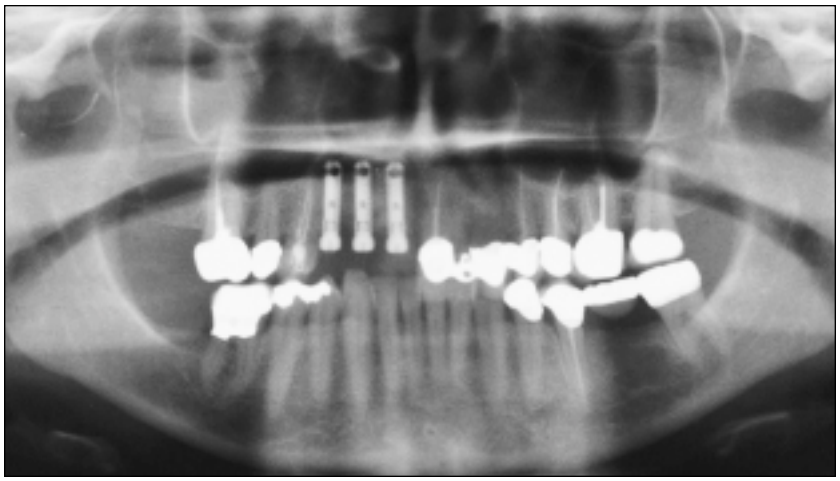

Fig 5e Postoperative panoramic radiograph with parallel implant placement and the adjacent teeth.

intra-arch topography are distorted by soft tissue flaps, various stages of edentulism, remaining tooth malalignment, or in situations of undesirable and irregular bone resorption. Once the template is in place, the surgeon can proceed rapidly through the stages of implant site preparation without repeatedly checking angulation and position of the preparation site, as is required with free-hand techniques. The sleeves provide the angulation and position and guide the drill. Perhaps the greatest benefit that the drill guide sleeve provides is a very concentric implant preparation site, unlike that which is created by a free-hand technique when the drills are introduced, repositioned during use, and withdrawn. A more concentric preparation site provided by the stainless-steel sleeves may increase bone-implant interface. The guide sleeves' one drawback is that they are restrictive where bony anatomy is aberrant or when the overlying gingiva is reflected and a change in implant site may be needed. However, when this occurs, the sleeve position can be changed or the template modified to change the implant preparation site.

Using stainless-steel sleeves provides an accurate, simplified method to facilitate implant placement and takes the guesswork out of determining the angulation and position of implant site preparation.

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