Using drill stops on twist drills to promote safety and efficiency when creating osteotomies for dental implants

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ABSTRACT

Background. A growing number of dental implants are being placed each year in the United States. This upward trend is associated with an increased incidence of comorbidities. In this regard, use of a drill stop has the potential to decrease unintended consequences of overdrilling the depth of an osteotomy.

Methods. The authors did not find any studies in the dental literature in which researchers assessed the safety and effectiveness of using drill stops on twist drills. Nevertheless, the advantages of utilizing drill stops and the undesired results due to excessive drilling can be reasonably deduced.

Results. The authors describe the following clinically relevant issues pertaining to overdrilling of osteotomies for dental implants: the anatomical effect of excessive drilling in different sections of the oral cavity, reasons for excessive drilling, methods to avoid overlengthening of implant sites and benefits of using drill stops on twist drills.

Conclusions. Use of drill stops enhances safety, accuracy and efficiency when creating an osteotomy. Drill stops also reduce the clinician's and patient's stress during operative procedures.

Practical Implications. Drills stops can be beneficial when utilized in situations in which there is reduced visibility, making it difficult to read the lines on a twist drill. They also are helpful when there is a dearth of bone over the mandibular or mental nerves, and precisely lengthened osteotomies are needed to avoid nerve injuries.

Key Words. Drill stops; mandibular canal; complications; osteotomy; implants.

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Dental implants should be positioned correctly, and this can be accomplished safely and efficiently. However, clinicians inadvertently can create an osteotomy deeper than desired. This can have negative consequences in different regions of the mouth. To facilitate the creation of precisely lengthened osteotomies, clinicians can use drill stops on twist drills.

Clinicians should consider factors that may contribute to a mistake with respect to osteotomy depth. In this report, we address several issues: undesired results due to overdrilling, factors that predispose clinicians to making this error and benefits attained by using a drill stop when preparing an osteotomy. We should note that, to our knowledge, there are no studies in the literature in which investigators evaluated the safety and efficacy of using drill stops. However, advantages related to drill stop use and complications associated with not using drill stops can be forecast.

FACTS AND FIGURES

As the population in the United States ages, there will be an increasing need for dental implants to replace missing teeth. This statement is predicated on the following facts: the population's longer lifespan, the relationship of tooth loss to age, the psychological aspects of losing teeth, the poor performance of removable prostheses, and the predictable long-term results and benefits of implant-supported prostheses.[1] More than 3 million people in the United States have dental implants,[2] and they are used in 15 to 20 percent of prostheses to replace lost teeth.[3]

In 2010, 1 to 2 million implants were placed, and by 2020, 2 to 4 million implants are expected to be placed annually in the United States.[4] However, it is projected

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that there will be more complications associated with a greater number of implant insertions.[4] Accordingly, clinicians should perform implant procedures in a manner that ensures safety.

TREATMENT PLANNING

Establishing a plan of action before initiating therapy is an important step in achieving successfully supported implant prostheses. The number, position, length and width of implants to be placed depend on the type of prosthesis to be fabricated and the availability and type of alveolar bone present. Clinicians should make these decisions before initiating treatment, but sometimes choices have to be modified during surgery owing to factors such as bone density. To help establish a treatment plan, the clinician performs a clinical and radiographic examination. If additional information is needed, he or she can order a computed tomographic (CT) scan.

In preparation for osteotomy creation, the clinician determines implant length with respect to the amount of available bone and location of adjacent anatomical structures. In this regard, we make suggestions in this report concerning maximum drill depths in different regions of the mouth. It is not the intent of this discussion to recommend implant lengths that would vary on the basis of numerous factors (such as the amount of available bone, bone density, type of prosthetic construct, occlusal forces). The purpose of this article is to address a technique—drill stops on twist drills—that facilitates achieving precise osteotomy lengths and prevents untoward outcomes caused by overdrilling.

TYPES OF STOPS

Numerous implant manufacturers (such as Straumann USA, Andover, Mass.; Zimmer Dental, Warsaw, Ind.; Biomet *3i*, Palm Beach Gardens, Fla.; Nobel Biocare, Mahwah, N.J.) offer drill stops that are sized specifically for twist drills that correspond to their companies' implant widths. Universal drill stops also are available (for example, Zosseo, Seattle) that can fit onto drills from multiple companies.

Reusable (for example, Zimmer Dental, Nobel Biocare) and one-time use (for example, Straumann USA, Biomet *3i*) drill stops are manufactured. The drill stop sets that are disposable can be used with reusable (for example, Biomet *3i*) or disposable (for example, Straumann USA) drills.

Drill stops usually are color coded for easy identification of size. Figures 1 and 2 are examples of commercially available disposable drill stops, and Figure 3 (page 374) shows examples of reusable drill stops.

CONSEQUENCES OF DRILLING TOO DEEPLY IN VARIOUS SECTIONS OF THE MOUTH

Drilling osteotomies to a depth greater than desired in different areas of the mouth can induce unwanted outcomes, as described as follows.

Mandibular posterior region. The trigeminal nerve—the fifth cranial nerve—possesses three main branches: ophthalmic (V_1), maxillary (V_2) and mandibular (V_3).[5] The mandibular nerve gives rise to the inferior alveolar nerve.[5] It enters the mandibular canal on the medial surface of the ramus near the lingula.[5]

Mandibular canal. When an osteotomy is created in the posterior mandibular area and the drill inadvertently enters the mandibular or mental canal, a paresthesia can be induced.[6] The paresthesia may include the skin over the mental foraminal area, the lower lip, the chin, adjacent mucous membranes and gingiva.[6] The mandibular canal typically has cortical bone surrounding it, which provides little resistance to drilling. Littner and colleagues[7] calculated that the mandibular canal was situated 3.5 to 5.4 millimeters subjacent to root apexes of the first and second molars. However, the nerve canal can be juxtaposed to the apex of the mandibular molar.[8] Therefore, to circumvent complications in the posterior mandible, the clinician should confirm the position of the nerve before developing an osteotomy. It is important that the clinician measure the length of bone from the crest of the ridge to the mandibular canal and take steps to ensure that the drill does not enter the nerve canal. A drill stop placed on all twist drills used in the mandibular posterior region is an excellent technique to avoid accidental overdrilling. In general, it is prudent to leave 2 mm of safety room between the mandibular nerve canal and the apical termination of an osteotomy.[6]

Mental foramen and anterior loop of the mental nerve. The mandibular nerve usually splits into two nerves in the region of the mandibular first molar.[9] The mental nerve emerges from the mental foramen and the incisive nerve continues anteriorly.[5] The mental foramen often is located between the apexes of the mandibular premolars, and its position varies in the vertical plane.[10] In the first and second premolar areas, the foramen can be coronal to the apex 38.6 percent and 24.5 percent of the time, respectively.[10] Therefore, practitioners must exercise caution regarding osteotomy length when placing an immediate implant in the mandibular premolar area.

The anterior loop of the mental foramen refers to the inferior alveolar nerve when it courses inferiorly and anteriorly to the foramen and then loops back to emerge from the foramen.[11] If the clinician plans to insert an implant mesial to the mental foramen that is longer than the safety distance (that is, from the mental foramen to the alveolar crest of the bone minus 2 mm), obtaining a CT scan is recommended to determine if an anterior loop is present.[11] When placing an implant over the mental foramen or over the anterior loop of the mental nerve, it is recommended that clinicians use stops on twist drills to avoid drilling deeper than desired.

Submandibular fossa. If a large undercut is in this

ABBREVIATION KEY. **CT:** Computed tomographic.