

## DENTAL TECHNIQUE

# Validating implant torque limiting devices with a customized tool: A dental technique

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Abutment screw loosening is one of the most common prosthetic complications with a reported incidence of approximately 10%.<sup>1-4</sup> The cause of screw loosening is multifactorial, but a major factor is inappropriate torque delivery during screw tightening.<sup>5</sup> Dental torque limiting devices (TLDs) provide a means of delivering a measured torque to dental implants and associated componentry. They may be manual or electric, in the form of wrenches, or have a similar design to a dental handpiece.

Screw mechanics has been well studied in the engineering industry, where TLDs are extensively used and standards have been adopted.<sup>6,7</sup> The International Organization for Standardization (ISO) develops and publishes documents that provide requirements, specifications, guidelines, or characteristics that can be used to ensure that materials, products, processes, and services conform to standards for quality, reliability, and safety. One such standard is ISO 6789-2:2017, "Assembly tools for screws and nuts—Hand torque tools—Part 2: Requirements for calibration and determination of measurement uncertainty".<sup>8</sup> This ISO standard provides recommendations on the minimal interval between calibration for all types of TLDs, based on frequency of

## ABSTRACT

The dental torque limiting device is a tool used to deliver a measured torque to implants and to their associated components. The torque delivery must be accurate and precise, especially when considering screw joints. Similar torque wrenches are used in various industries, and recommendations on calibration are provided by the International Organization for Standardization 6789-2:2017. It states that hand torque tools should be calibrated annually or more frequently if subjected to extreme temperature conditions such as steam sterilization. The International Organization for Standardization standard recommends that calibration may be performed by direct comparison of 2 torque devices provided that 1 is known to be within calibration. This technique article describes the procedures for fabricating a tool that couples 2 dental torque limiting devices. It may be used for calibrating and validating both electrical and mechanical torque limiting devices. (J Prosthet Dent 2020;■:■-■)

use, typical loading during use, ambient conditions during operation, and storage conditions. These



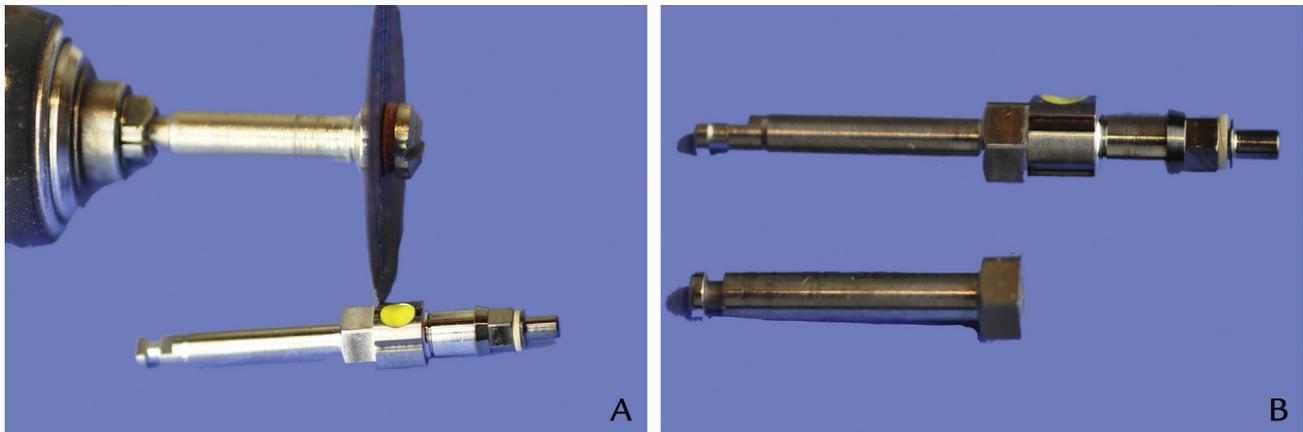
**Figure 1.** Implant driver (Nobel Biocare. Conical connection. RP).

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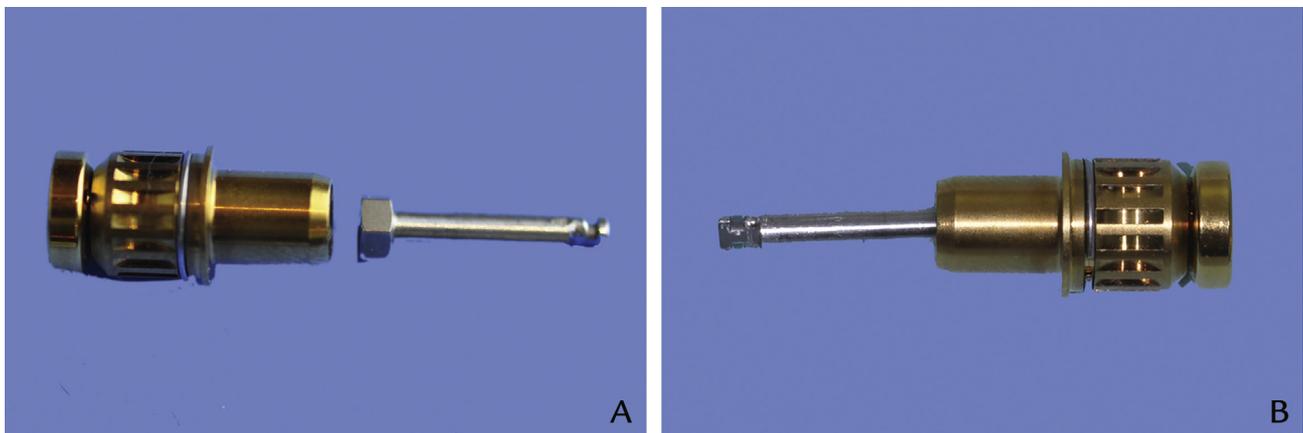
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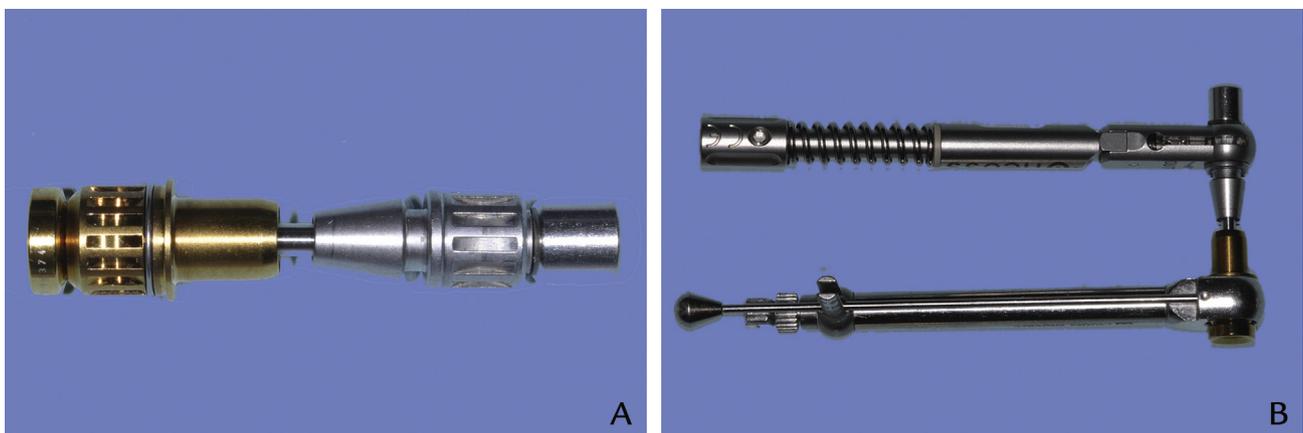
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**Figure 2.** A, Sectioning implant driver, retaining hexagonal end. B, Comparison before and after sectioned implant driver.



**Figure 3.** A, Sectioned implant driver and wrench adapter-surgical (gold colored). B, Coupling device assembled.

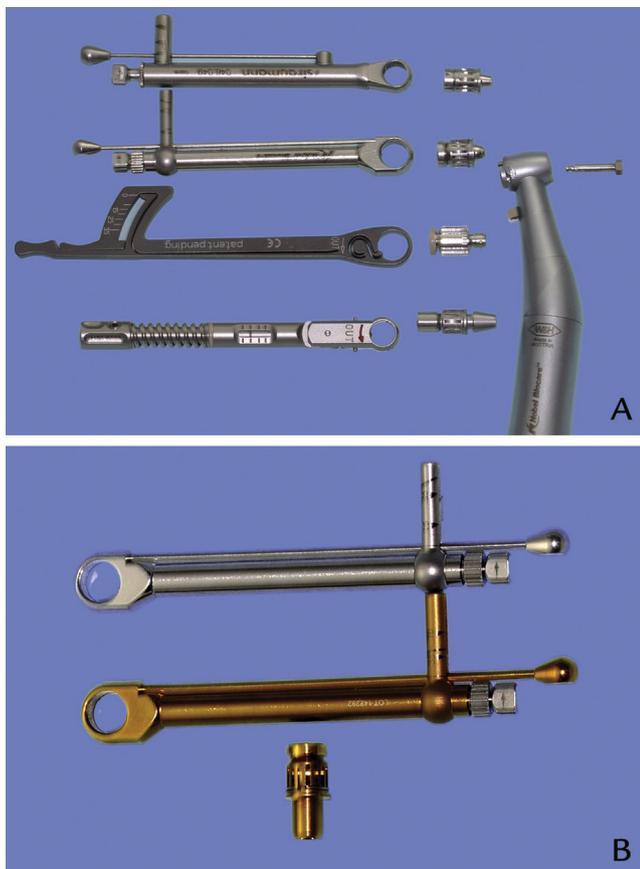


**Figure 4.** A, Tool connecting 2 manual torque wrench adaptors (finger drivers). B, 2 torque limiting devices with coupling tool.

recommendations also apply to torque wrenches used in implant dentistry.

For dental TLDs where sterilization between patients is mandated, the effects of steam sterilization on TLDs have been studied. Significant differences have been reported between target torque and actual delivery torque values, with a greater error occurring at higher torque

values and with an increased trend especially at higher torque values.<sup>9-14</sup> It has also been reported that the accuracy of certain mechanical types of TLDs were more susceptible to repeated use and sterilization, as well as aging.<sup>15</sup> Autoclave procedures can corrode moving parts in some TLDs, producing inaccurate values as high as 455% of the target torque.<sup>13</sup> These studies suggest that



**Figure 5.** A, Variety of TLDs with latch grip connection. B, Wrench adaptor (surgical-gold colored) with compatible TLDs. TLDs, torque limiting devices.

the ISO 6789-2 recommendations of a default calibration interval of 12 months may be too long for dental TLDs.<sup>8</sup>

TLDs can be validated in various ways, including the use of electronic or mechanical calibration devices, as well as more straightforward methods such as measurement of length and weight and calculation of moments of force.<sup>15,16</sup> A TLD which has been calibrated and is known to be accurate can also be used as a standard according to the ISO 6789-2, with other torque wrenches being compared with this reference if they can be directly coupled.<sup>8</sup>

The purpose of this technique article was to describe the fabrication of a tool that may be used to couple 2 implant TLDs, where 1 is known to be calibrated accurately and will act as a measuring tool against which a second tool can be compared or validated. The coupling tool may be used to calibrate both mechanical and electrical type implant torque wrenches.

## TECHNIQUE

1. Take an implant driver (Implant driver conical connect RP; Nobel Biocare Services AG) that has a



**Figure 6.** Coupling electric torque delivery to mechanical beam torque wrench.



**Figure 7.** Two mechanical torque limiting devices coupled (Note: beam wrench reading in error, requires calibration or replacement.)

hexagonal fitting close to the latch grip end (Fig. 1). The driver can be either new or used, but the hexagonal fitting must show no wear. Section it with a metal cutting disk (Dura-thin metal cutting abrasive disk; Keystone Industries) at the hexagonal junction away from the latch grip (Fig. 2A, 2B).

2. Ensure the cut hexagonal end fits with the implant manual torque wrench adapter (Manual torque wrench adapter, surgical; Nobel Biocare Services AG), (gold colored) contains the reciprocating hexagon connection at one end, with the other finger grip handle at the other (Fig. 3A). When combined these 2 parts provide a coupling device (Fig. 3B).
3. The latch grip end of the coupling device is considered a universal connection and may be placed into any latch grip device, including manual torque wrench adaptors, finger screw drivers (Fig. 4), and directly into a variety of torque limiting devices that have latch grip connections or attachments (Fig. 5).

4. One side of the coupling device is used for a TLD known to be in calibration as a reference torque device. Connect the reference device to another TLD to be checked. Action the reference device and record the measurement displayed on the reference device.
5. In cases where an electric TLD is being checked, action it and not the mechanical calibrated reference device (Fig. 6).
6. If both the reference TLD and the TLD being tested display similar values consistently, then it can be assumed that the test device is in proper calibration. If they do not, then the test torque wrench must be recalibrated or replaced (Fig. 7).
7. The testing should be carried out regularly, as TLDs are subjected to adverse environments such as steam autoclaving and debris and corrosion products that affect their ability to correctly provide the desired torque.

## DISCUSSION

ISO 6789 provides a standard of reliability, quality, and safety, with 6789-Part 2 relating to the verification of hand torque tools.<sup>8</sup> Implant dentistry frequently relies on TLDs for a variety of clinical procedures. Incorrect torque application may compromise these procedures.

TDLs used in dentistry are exposed to extreme conditions, including moisture and heat that can affect their use.<sup>6,13,14</sup> Other factors such as frequency of use, design, and especially if they seem damaged also mandate verification of accuracy.<sup>8</sup> When found to be in error, the torque wrench must be calibrated or replaced.<sup>10</sup> As recommended by the ISO 6789-2,<sup>8</sup> torque calibration should be undertaken with a calibrated testing device, which in this case uses a TLD known to be accurate and precise.

A limitation of this technique is that 1 TLD must be dedicated for such use and ideally should not use clinically but be kept solely for the purpose of verification. Also, although this tool allows multiple manufacturer wrenches to be calibrated through the latch grip end, the other end of the device must be compatible with the manual torque wrench adapter-surgical version used.

## SUMMARY

A technique to validate a dental torque limiting device against a known standard device by using a custom fabricated coupling tool is described. It allows the clinician to check the precision and accuracy of a torque wrench at any time in a fast, effective manner.

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