# Accuracy of Mechanical Torque Devices for Implants Used in Brazilian Dental Offices

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The purpose of this study was to determine the accuracy of mechanical torque devices in delivering target torque values in dental offices in Salvador, Brazil. A team of researchers visited 16 dental offices, and the clinicians applied torque values (20 and 32 Ncm) to electronic torque controllers. Five repetitions were completed at each torque value and data were collected. When 20 Ncm of torque was used, 62.5% of measured values were accurate (within 10% of the target value). For 32 Ncm, however, only 37.5% of these values were achieved. Several of the tested mechanical torque devices were inaccurate. *Int J Prosthodont 2011;24:38–39.*

An important factor in providing the appropriate preload to the screw joint and offering protection against screw loosening is the accurate delivery of torque to dental implant prosthetic screws.[1] Excessive torque to the screw can create permanent deformation, resulting in screw fracture.[2,3] Additionally, inadequate torque delivery has been mentioned as one of the causes of screw loosening.[4] When the abutment screw is tightened into place, it provides a preload within the screw, placing the abutment-implant interface under compression.[5] Component surface wear, micromovement, and embedded relaxation during functional loading may gradually erode the preload and cause progressive slippage and screw joint failure.[5]

The age of the device, frequency of use, debris in the operating mechanisms, and corrosion of the spring in the handle of the torque device can provide inappropriate torque values to screws, with errors as large as 455%.[2] Considering the factors mentioned, the purpose of this study was to determine the accuracy of mechanical torque devices used in dental offices in Salvador, Bahia, Brazil, in delivering target torque values. Note that only torque was covered in this study; however, the applied torque and friction both affect the optimal preload in the screw joint.

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## Materials and Methods

Dental offices were selected in Salvador, Bahia, Brazil, on the basis of specific criteria, including the stipulation that the participating clinician was using mechanical torque devices on a routine basis. Based on these criteria, only 16 dental offices were selected. A team of research assistants, who were trained previously until they reached 0.61 to 0.80 Kappa Index, visited the dental offices, and the mean torque delivered by each device was evaluated to determine their accuracy to the target torque (20 and 32 Ncm).

The manual torque wrenches tested (n = 16) were fabricated by four different manufacturers: Straumann (n = 1), Conexão (n = 6), Biomet 3i (n = 3), and Nobel Biocare (n = 6). All devices were in use for less than 2 years and were not calibrated by the clinician after acquisition.

At each office, researchers tested the devices by applying torque to one healing abutment (Biomet 3i) placed on a digital torque meter (TQ-680, Instrutherm) and repeated the measurements five times for each target torque value. One healing abutment was used for each office. Data were collected and the mean of each target torque value from each office was calculated (16 means each for 20 and 32 Ncm of torque). The accuracy (± 10% of the target value) of the mechanical torque devices was evaluated.

## Results

The majority of the mechanical torque devices evaluated showed deviation from the targeted torque value. When the torque used was 20 Ncm, mean values ranged from 16.4 to 25.9 Ncm (Fig 1). These values were considered accurate for 10 offices (62.5%), higher than the target in 2 offices (25.9 and 25.1 Ncm), and

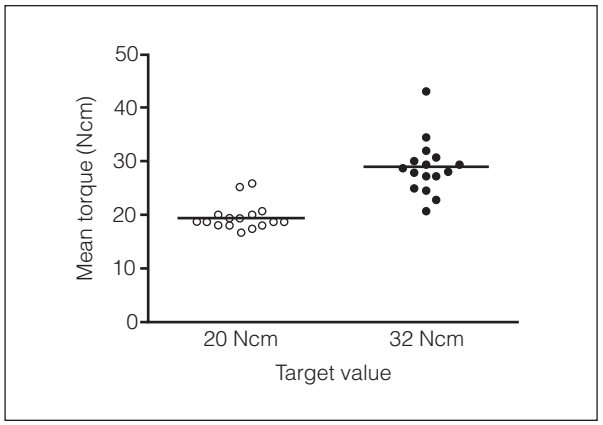



**Fig 1** Dispersion diagram of mean torque values for the force applied to the healing abutment for each office visited.

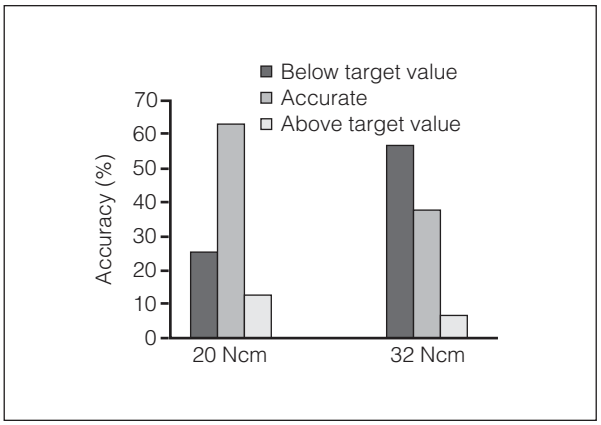
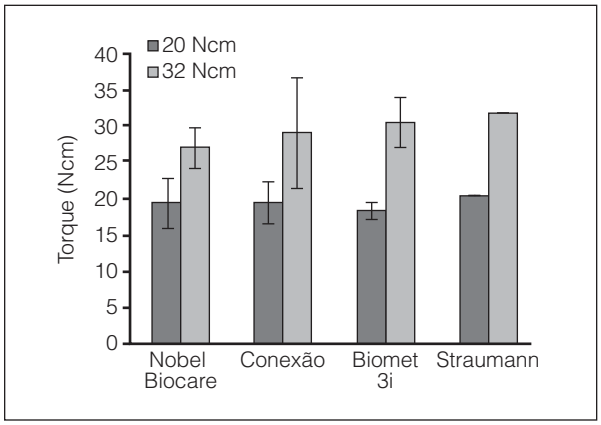



**Fig 2** Accuracy of the mechanical torque devices evaluated.

**Fig 3** Means and standard deviations of torque values read from the different devices.




lower than the target in 4 offices (Fig 2). When 32 Ncm was used, mean torque values varied from 20.9 to 43.2 Ncm (Fig 1). These values were considered acceptable for 6 offices (37.5%), 1 office presented a higher mean value (43.2 Ncm), and the other 9 presented a mean value lower than the target (Fig 2).

The four different torque devices listed in this study were compared, and the mean torque values for each manufacturer were calculated (Fig 3). Torque devices from Nobel Biocare presented a lower mean value than that considered acceptable in this study (± 10% of the target value) when the target was 32 Ncm. When the torque used was 20 Ncm, 50% of Nobel Biocare and 66.7% of Biomet 3i and Conexão values were considered acceptable. When 32 Ncm was used, 33.3% of all values from each manufacturer were considered accurate. The torque device from Straumann presented the most consistent delivery of torque for both 20 and 32 Ncm.

## Discussion

It is clear that several of the tested mechanical torque devices evaluated in this study revealed considerable differences in their accuracy to achieve the target torque values. Since the stated objective of using a torque device is to ensure consistency and accuracy in tightening implant components, the results of this preliminary study suggest that determining desired and prescribed applied torque amounts may not be as reliable as hoped for. Clinicians should be aware of the conditions and accuracy of their preferred mechanical torque devices if proper and repeatable torque application is to be a reliable clinical guide.

## Conclusion

Several of the tested mechanical torque devices were not accurate. This preliminary study suggests that different torque devices may produce different, and consequently misleading, values.

## References

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