T3® PRO IMPLANT

Consistent Osseointegration Across Multiple Treatment Protocols

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Real-World Evidence on T3 PRO Implants

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SUMMARY

Primary stability and osseointegration of the T3 PRO Implant were assessed using real-world data from 796 patients (ages 16 to 95 years; mean age: 62.0 ± 1.81 SE) and 1,194 implants. The results demonstrate that T3 PRO Implants consistently support a variety of restorations—including single and multiple crowns as well as full-arch fixed dentures.

Implant stability was evaluated using a torque test conducted, on average, 21.1 weeks (± 1.54) after placement. Impressively, **98.3% of implants passed this test,** confirming their readiness for final restoration without additional healing time. Importantly, there was no observed correlation between failed torque tests and insertion torque values (ITVs) or other factors that typically influence osseointegration.

These findings highlight the versatility of T3 PRO Implants in achieving sufficient primary stability across a wide range of torque values, as well as consistent secondary stability across diverse clinical protocols.

Whether used in routine procedures or more complex clinical scenarios, T3 PRO Implants demonstrate dependable performance across various sites, placement techniques, and loading strategies—providing clinicians with flexibility and confidence in their treatment planning.

Study Objectives and Characteristics

T3 PRO Implants build on the clinical success of 3i T3® Implants by offering improved insertion and apical stability. We evaluated how insertion torque (Objective 1) and treatment protocols (Objective 2) impact the success of T3 PRO Implants at our oral and maxillofacial surgery clinic. The majority of implants were platform-switched, with standard diameters (5 or 6 mm) and lengths (10 or 11.5 mm), and were placed in posterior jaw sites. Bone grafting or sinus floor elevation (SFE) was less often required. Healing Abutments were connected after implant placement, except for a small number of implants that received a Provisional Restoration instead. The total number of patients and implants that underwent various implant treatment protocols are summarized in Table 1.

Table 1. Implant Treatment Protocols per Patients and Implants

Implant Treatment Protocols	Patients (n)	Implants (n)
Total	796	1194
Maxilla		
Anterior	118	174
Posterior	347	454
Mandible		
Anterior	43	74
Posterior	379	492
Implant Placement		
Immediate	547	722
Delayed	249	472
Bone Graft for Alveolar Ridge		
Yes	182	233
No	614	961
Sinus Floor Elevation (SFE)		
Yes	174	202
No	622	992
Implant Diameter		
3 mm	9	10
4 mm	86	124
5 mm	325	454
6 mm	517	606
Implant Length		
8.5 mm	70	93
10 mm	486	692
11.5 mm	279	353
13 mm	47	54
15 mm	2	2
Platform-Switched	787*	1167
Platform-Matched	13*	27
Total Immediate Loading	12	50
Single-Unit (Non-Occlusal)	3	3
Multiple Unit	2	12
Full Arch	7**	35
Total Delayed Loading	784	1144
Single Unit	569	569
Multiple Unit	213	543
Full-Arch	9**	32

**4 Patients Received Platorm-Switched and Platform-Matched Abutments*
***2 Patients w/Full-Arch Received Delayed and Immediate Loading*

Objective 1:

Insertion Torque Value (ITV) and Osseointegration

Does insertion torque truly predict osseointegration success?

Real-world results with T3 PRO Implants suggest otherwise. Implant failure occurred in only 1.7% of cases and showed no correlation with insertion torque values (ITVs). Whether the torque was low, moderate, or high, implant success remained consistently high.

The relevance of ITV, as a measure of primary stability in predicting successful osseointegration, was assessed in T3 PRO Implants, which are designed with several features that enhance primary stability. For instance, the tapered implant core, with progressively increasing thread depth, allows for greater bone engagement leading to high initial bone-to-implant contact (IBIC) and increased apical stability. Additionally, sharp flutes enable self-tapping at an increased cutting efficiency for controlled insertion.

Insertion torque value, expressed in Newton centimeters (Ncm), was measured immediately after implant placement. Progressive osseointegration was evaluated by performing a torque test after a mean follow-up period of 21.1 weeks (± 1.54 SE). The impact of low (< 30 Ncm), mid (30 to < 50 Ncm), or high (≥ 50 Ncm) ITV was assessed for its association with implant failures following the torque test. The torque test involved the repeated application (three times) of a forward torque followed by a reverse torque, starting at 10 Ncm and then increasing to 20 Ncm. Passing the torque test determined whether the patient could proceed with a final restoration or required additional healing time. Upon passing the torque test, the patient was referred to a general dentist or prosthodontist for the final restoration. Delayed scheduling of torque test appointments did not allow for immediate loading, except in cases of functional need, which primarily involved full-arch restorations.

The following histogram (Figure 1) represents the number of T3 PRO Implants that passed the torque test with low, mid, or high ITV. The categorical ITV values were assessed using a Chi-Square (X2) test to determine their association with implant failure versus success. A Fisher's Exact Test was used for small sample sizes. Statistical significance was set at $P < .05$. No statistically significant correlation was found for any of the ITV categories when comparing implants that failed versus those that passed the torque test.

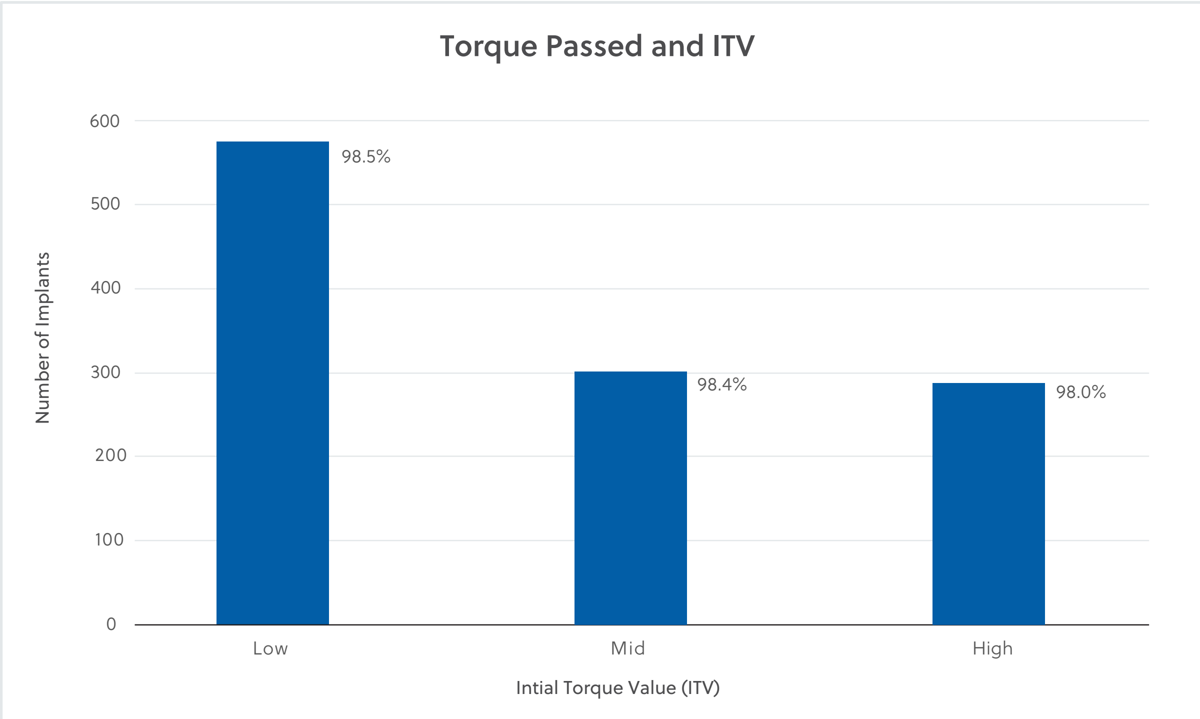

Fig. 1 *T3 PRO Implants showed high success across low (< 30 Ncm), mid (30 – 50 Ncm), and high (> 50 Ncm) ITVs—allowing flexibility for clinicians during implant placement.*

An implant's ability to osseointegrate initially depends on its mechanical stability (i.e., primary stability). Implant micromovement due to insufficient primary stability can lead to the formation of fibrous tissue instead of bone, resulting in implant failure. Conversely, excessive pressure on the surrounding bone during implant insertion may result in bone microfractures and, ultimately, implant failure. Several factors influence primary stability, including implant design, bone quality and quantity, and patient health. These factors guide clinicians in determining the most appropriate implant placement protocol (Heimes et al., 2023; Putra et al., 2024). Insertion torque value is the most common measure of implant primary stability (Darriba et al., 2022). However, there is no consensus on a minimum or maximum ITV value that reflects primary stability for successful implant treatment, or the decision to immediately load an implant. Acceptable intervals have been reported as 25 - 45 Ncm for immediately loaded implants, but values outside of this range have also yielded favorable clinical outcomes (Darriba et al., 2022). Furthermore, there is comprehensive clinical evidence from systematic reviews indicating that a high ITV is not always necessary for implant survival (Darriba et al., 2022; Monje et al., 2019) or low marginal bone loss (MBL, Berardini et al., 2016). In contrast, lower ITV has been associated with less bone resorption, increased formation of new bone formation, and faster osseointegration (Norton, 2017).

We did not identify any specific ITV or range that could reliably predict osseointegration of T3 PRO Implants. Nevertheless, the implants consistently demonstrated strong primary stability—likely due to design features that enhance bone engagement, even under lower torque conditions. For instance, implants with deeper threads and tighter pitch provide a greater surface area, which increases IBIC and supports mechanical stability (Heimes et al., 2023; Trisi et al., 2015; Degidi et al., 2013). Additionally, a study showed that implants with different macrogeometries—such as tapered versus parallel-walled—can exhibit similar ITVs, yet differ significantly in the actual bone contact achieved when placed in low density bone blocks (Yang et al., 2024). This finding suggests that primary stability is influenced not just by the amount of torque applied, but also by the implant's geometry and surface interaction with bone.

While primary stability is key for mechanical stability during implant placement, the ultimate goal is to achieve secondary stability (i.e., osseointegration) through biological integration with the bone (Norton, 2017). Secondary stability involves a biological interaction where osteogenic cells resorb and regenerate bone, forming a bond with the implant's surface topography. A randomized clinical trial investigated the relationship between ITV and secondary stability measured by resonance frequency analysis across two implant macrogeometries and implant sites (Gehrke et al., 2023). Results indicated that there were no significant differences in ITV and other measures of primary stability between the two implants. Interestingly, lower ITV values correlated with better osseointegration and bone growth around both implants following surgical healing. These results suggest that low ITV may be beneficial for the long-term stability of implants. Furthermore, the establishment of IBIC promotes osteoconduction, which combined with the implant's surface topology, facilitates bone remodeling and new bone formation for long-term secondary stability.

Objective 2:

Impact of Bone Quality, Design, and Protocols

The dataset was evaluated to assess the success of T3 PRO Implants with respect to the following typical factors that influence osseointegration:

- Bone Quality (implant site, bone graft, SFE)
- Implant Dimension (diameter, length)
- Implant Placement (immediate, delayed)
- Loading Type (immediate/delayed for single/multiple units or full arch)

None of these variables showed a significant impact on implant success. These findings strongly support the use of T3 PRO Implants across a broad range of clinical scenarios, owing to their enhanced apical thread engagement and advanced surface properties--which contribute to reliable primary stability and predictable long-term osseointegration, respectively.

Implant sites were categorized into anterior and posterior regions of the maxilla and mandible reflecting differences in bone quality and quantity. Bone grafting in the alveolar ridge or SFE presupposes inadequate bone quality that sets a disadvantageous precedence. Additionally, implant dimensions (diameter, length) as well as immediate placement and loading may impact osseointegration in different ways. The following histograms depict the number of implants that passed the torque test based on variables related to bone quality (Figure 2), implant dimension (Figure 3), and implant placement and provisional restoration loading (Figure 4). No statistically significant correlation was found for any of the variables when comparing implants that failed versus those that passed the torque test. Abbreviations used include anterior (A), posterior (P), diameter (D), length (L), immediate (I), and delayed (D).

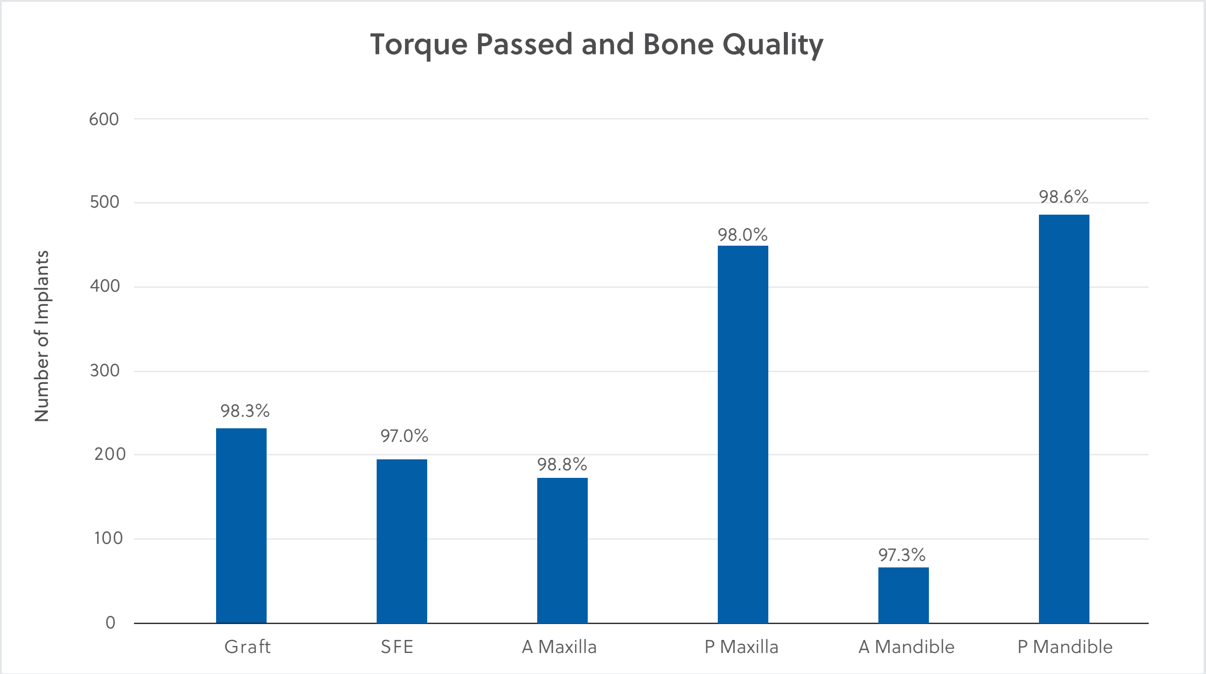

Fig. 2 *T3 PRO Implants demonstrated high success rates even in challenging surgical scenarios, including sites that required bone grafting or sinus floor elevation (SFE), as well as across a range of bone densities—from high-density anterior areas to lower-density posterior areas. These results underscore the implant's reliability in complex treatment planning.*

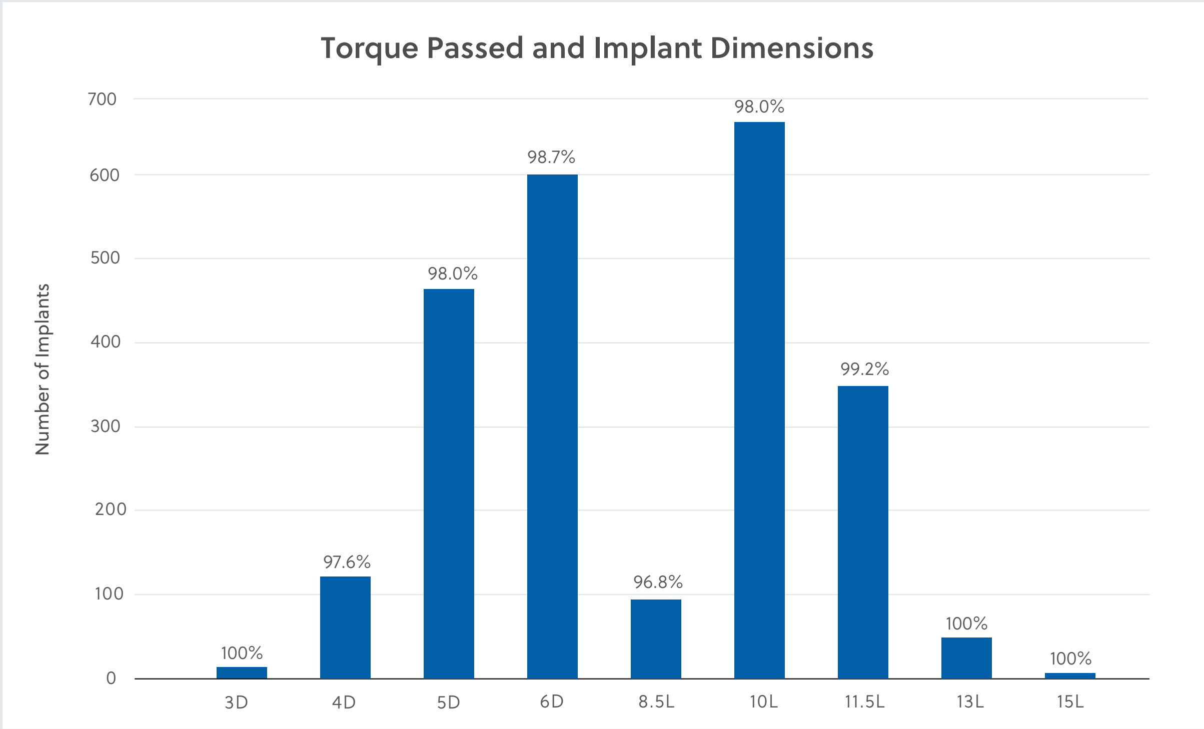

Fig. 3 *T3 PRO Implants showed high success across various diameters and lengths—emphasizing consistency in design attributes that promote stability.*

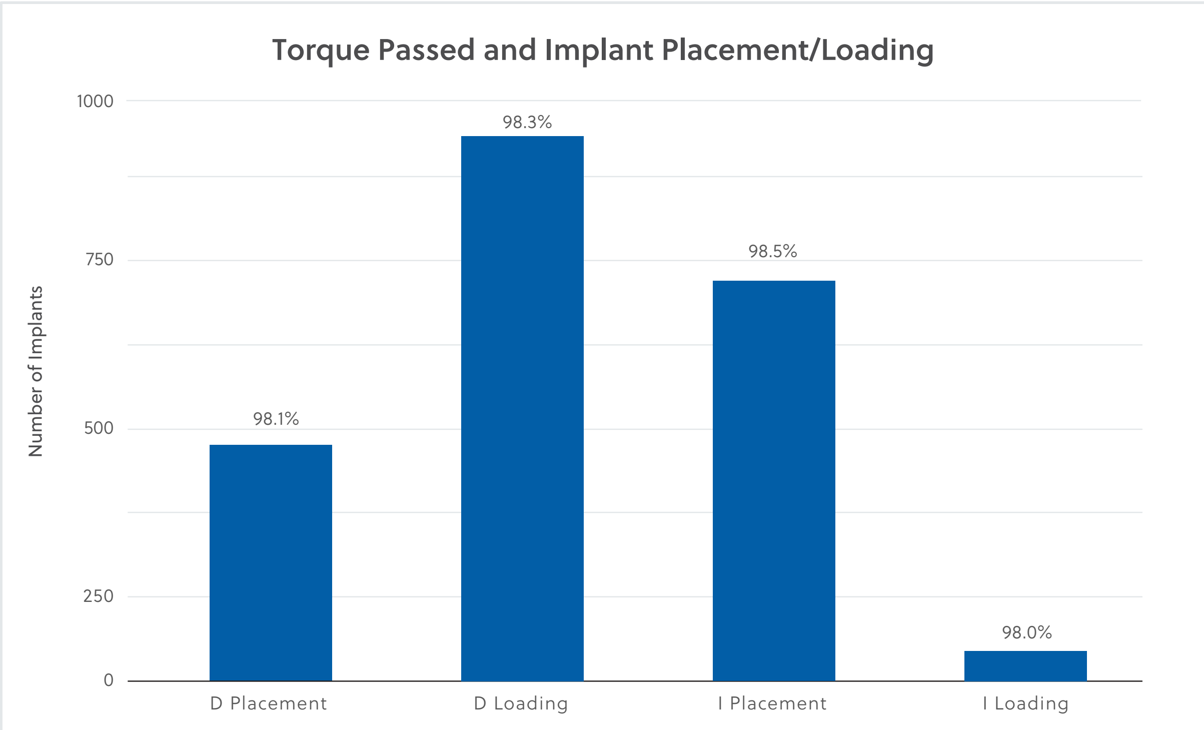

Fig. 4 *T3 PRO Implants showed high success across delayed or immediate placement or loading protocols—enabling clinicians to tailor care for optimal patient outcomes.*

While several key factors influencing osseointegration were analyzed, not all possible variables were captured in the dataset. For example, differences in patient-specific bone quantity and quality were not individually assessed. Additionally, osseointegration may be influenced by the interaction of multiple variables—such as bone quality, implant dimension, and implant placement or loading protocols—rather than by a single factor alone. To explore this, we evaluated combinations of two or three variables and their relationship to implant success or failure using Poisson regression analysis with statistical significance set at $P < .05$. However, due to the low number of implant failures, some combinations could not be statistically tested.

Initial analysis focused on combinations related to bone quality and implant design. For instance, no association was found between implant failure and combinations involving sinus floor elevation (SFE), bone grafting, and implant site. Similarly, combinations of implant diameter and length did not show a significant relationship with torque test outcomes. While delayed implant placement may provide more time for bone healing, and larger implants could enhance initial stability (Heimes et al., 2023), no significant correlation was observed between these combined variables and implant failure.

The surface topography of T3 PRO Implants promotes osseointegration by creating conditions for bone remodeling and formation around the implant.

One influential factor of osseointegration that remained consistent throughout was the implant surface. T3 PRO Implants feature a coarse-micron, resorbable media-blasted surface overlaid with a fine-micron, Dual Acid-Etched (DAE) surface. At the fine-micron level, osteogenic secretions accumulate within the acid-etched pits, forming a layer across the surface, while coarse-micron peaks anchor the collagen matrix. This dual interaction stabilizes new bone formation (Davies et al., 2014). Preclinical mechanical testing shows that implants with increased surface complexity enhance the biologic mechanisms that strengthen bone bonding (Davies et al., 2014).

T3 PRO Implants are designed with a DAE collar to reduce bacterial colonization while promoting osseointegration at the crestal or subcrestal level. For the clinician, this means greater confidence placing T3 PRO implants—even in challenging bone conditions.

Micron-scale topography is beneficial for long-term stability provided that it also minimizes bacterial attachment. Bacterial attachment typically occurs on exposed surfaces, such as the implant-abutment junction. Preclinical bench testing demonstrates that the DAE surface is below the critical threshold for bacterial attachment (Wang et al., 2025; Park et al., 2019). A multicenter randomized clinical trial upholds that the DAE surface around implant collars does not increase the risk of peri-implantitis over a 5-year period compared to a machined surface (Zetterqvist et al., 2010). Additionally, a 10-year prospective cohort study found that implants with a DAE collar had less marginal bone loss versus those with a rougher surface created by combining DAE and media-blasting (de Angelis et al., 2020).

Concluding Remarks

Implant stability is influenced by several factors, including bone quality and quantity, implant design, and surgical approach. For more than 20 years, researchers have sought ways to quantitatively predict implant stability (Monje et al., 2019). While achieving successful osseointegration remains the ultimate goal, it is often guided by primary stability—commonly assessed through insertion torque value (ITV, Darriba et al., 2022; Monje et al., 2019). That said, there is still no clear consensus on what specific ITV range defines ideal primary stability. Clinicians generally aim to avoid torque values that are too low (which can lead to implant mobility) or too high (which can cause bone damage). However, recent clinical and preclinical studies have shown that high ITV is not always required for successful short- or long-term implant outcomes. Even implants with similar torque values can have different levels of bone contact, depending on their design.

In addition to mechanical stability, surface characteristics play a crucial role in the biological transition to osseointegration. The T3 PRO Implant's unique surface—featuring both coarse- and fine-micron textures—has been shown to promote early bone remodeling and new bone formation, while the fine-micron surface (i.e., DAE surface) of the implant collar allows for reduced bacterial attachment.

In summary, T3 PRO Implants demonstrate consistent, reliable stability and osseointegration across a wide range of clinical protocols and patient conditions. The evidence supports the use of flexible ITV thresholds, allowing clinicians to make confident decisions regarding immediate or delayed placement and loading—without compromising outcomes.

References

Berardini M, Trisi P, Sinjari B, Rutjes AW, Caputi S. The effects of high insertion torque versus low insertion torque on marginal bone resorption and implant failure rates: a systematic review with meta-analyses. Implant Dent. 2016;25(4):532-540.

Darriba I, Seidel A, Moreno F, et al. Influence of low insertion torque values on survival rate of immediately loaded dental implants: a systematic review and meta-analysis. J Clin Periodontol. 2023;50(2):158-169.

Davies JE, Mendes VC, Ko JC, Ajami E. Topographic scale-range synergy at the functional bone/implant interface. Biomaterials. 2014;35(1):25-35.

De Angelis N, Kassim ZH, Baharuddin IH, et al. Ten-Year Results of a prospective cohort study on acid-etched and airborne particle-abraded implant surfaces: a comparative study. Int J Periodontics Restorative Dent. 2020;40(5):e189-e196.

Degidi M, Daprile G, Piattelli A, Iezzi G. Development of a new implant primary stability parameter: insertion torque revisited. Clin Implant Dent Relat Res. 2013;15(5):637-644.

Gehrke SA, Cortellari GC, de Oliveira Fernandes GV, et al. Randomized Clinical Trial Comparing Insertion Torque and Implant Stability of Two Different Implant Macrogeometries in the Initial Periods of Osseointegration. Medicina (Kaunas). 2023;59(1):168.

Heimes D, Becker P, Pabst A, et al. How does dental implant macrogeometry affect primary implant stability? A narrative review. Int J Implant Dent. 2023;9(1):20.

Monje A, Ravidà A, Wang HL, Helms JA, Brunski JB. Relationship between primary/mechanical and secondary/biological implant stability. Int J Oral Maxillofac Implants. 2019;34:s7-s23.

Norton MR. The influence of low insertion torque on primary stability, implant survival, and maintenance of marginal bone levels: a closed-cohort prospective study. Int J Oral Maxillofac Implants. 2017;32(4):849-857.

Park SJ, Sanchez O, Ajami E, Wen HB. Bacterial adhesion to different dental implant collar surfaces: an in vitro comparative study. Poster presented at: 34th Annual Meeting Academy of Osseointegration; 15 March 2019; Washington DC.

Putra RH, Cooray U, Nurrachman AS, et al. Radiographic alveolar bone assessment in correlation with primary implant stability: a systematic review and meta-analysis. Clin Oral Implants Res. 2024;35(1):1-20.

Trisi P, Berardini M, Falco A, Podaliri Vulpiani M. Effect of implant thread geometry on secondary stability, bone density, and bone-to-implant contact: a biomechanical and histological analysis. Implant Dent. 2015;24(4):384-391.

Wang X, Liddell RS, Wen HB, Davies JE, Ajami E. The Role of Implant Coronal Surface Properties on Early Adhesion of Streptococcus Oralis-An In Vitro Comparative Study. J Biomed Mater Res A. 2025;113(1):e37866.

Yang B, Landa AI, Heuberger P, Ploeg HL. Effects of dental implant diameter and tapered body design on stress distribution in rigid polyurethane foam during insertion. Med Eng Phys. 2024;129:104181.

Zetterqvist L, Feldman S, Rotter B, et al. A prospective, multicenter, randomized-controlled 5-year study of hybrid and fully etched implants for the incidence of peri-implantitis. J Periodontol. 2010;81(4):493-501.

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