

Screw Loosening for Standard and Wide Diameter Implants in Partially Edentulous Cases: 3- to 7-Year Longitudinal Data

Sang-Choon Cho, DDS,* Paula-Naomi Small DDS, MPH,† Nicolas Elian, DDS,‡ and Dennis Tarnow, DDS§

Screw loosening is considered to be a common problem with both screw-retained and cemented implant restorations.¹ Several complications may arise as a result of loose retaining or abutment screws. There can be granulation tissue between the loose abutment and the implant, leading to fistulae formation and infection of the soft tissue. In addition, loose screws are more apt to fracture under load, leading to long-term prosthesis complications.²

The literature to date does not present a consistent trend of reported screw loosening. Some investigators have found that as little as 2%²⁻⁴ of all screws loosen, while others report a frequency of up to 40%.⁵ Naert et al⁴ reported that 5% of retaining gold screws loosened. Kallus and Bessing⁵ reported that 40% of slotted gold screws, and 10% of internally hexed gold screws loosened. Overall, 26% of all gold retaining screws loosened and 4% of all abutment screws loosened. These authors examined screw loosening in full arch restorations only and speculated that a higher frequency of screw loosening was expected with single tooth restorations. Jemt et al⁶ reported 26% loosening of gold retaining screws and 43% loosening of abutment screws over the first year on single tooth implants. Becker and Becker⁷ reported 38% loosening of single implant restorations in the posterior maxilla and mandible.

Screw loosening is considered to be a common problem with both screw-retained and cemented implant restorations. A wider abutment platform, as well as using a torque driver to tighten specifically designed screws may help prevent this loosening. However, there has been no clinical study evaluating either of these. To longitudinally compare the frequency of screw loosening in standard diameter, (3.75 and 4.0 mm) implant supported prostheses to that of wide diameter, (5.0 and 6.0 mm) implant supported prostheses that were hand tightened, and to evaluate whether using a torque driver would minimize or prevent this problem, if screw loosening occurred. A total of 213 dental implants in 106 patients were included in this prospective longitudinal study. Of the implants 68 were wide diameter

and 145 were standard diameter implants. Wide diameter implants showed 5.8% screw loosening, while standard diameter implants showed 14.5% screw loosening after insertion with only hand torquing. When these loose screws were tightened with a torque driver, there was no more loosening of screws. Within the limitations of this study, the wide diameter implants tested showed less screw loosening than the standard diameter implants when hand torqued. Additionally, within the scope of our study, using a torque driver to tighten the screws with the recommended force prevented this loosening from reoccurring in all cases. (Implant Dent 2004;13:1-●●●)

Key Words: torque, wide diameter implant, abutment, screw

ening of single implant restorations in the posterior maxilla and mandible.

The most likely cause of the majority of screw loosening is inadequate tightening of the screw.⁸ Another important factor is the design and nature (design refers to shape, thread style, head design, and driver shape needed to insert, while nature refers to type of metal) of the screw itself. It was discovered that internally hexed screws could be tightened (even by hand) to a higher degree than slotted screws.⁵ When a screw is tightened, a tensile force (preload) is built up in the stem of the screw. This preload creates a contact between the abutment and implant. The closer the tightening force approaches the recommended force

for any particular screw, the more stable the connection will be. Thus, the design of the head and body of the screw is significant and should allow a maximum of torque to be introduced in the stem of the screw. The design of the screw head, screw material and tightening force are all important parameters for screw joint stability. McGlumphy, in 1993, stated that the clamping load must be greater than the separating forces to keep screws tight. Therefore, it was recommended to maximize preload forces and minimize joint separating forces.

Other possible factors contributing to screw loosening include nonpassive frameworks,⁹ cantilevered frameworks, wide occlusal table, steep cusps, poorly

*Clinical Assistant Professor, Department of Implant Dentistry, New York University, College of Dentistry, New York, New York.† Clinical Associate Professor, Department of Implant Dentistry, New York University, College of Dentistry, New York, New York.‡Assistant Professor, Director of International Implant Program, Department of Implant Dentistry, New York University, College of Dentistry, New York, New York. §Professor, Chairman, Department of Implant Dentistry, New York University, College of Dentistry, New York, New York.

Table 1. Screw loosening in wide diameter implants vs standard implants

	Total	No. of Screws Loosened	% of Screw Loosening
Wide diameter implants	68	4	5.8
Standard diameter implants	145	21	14.5

fitting components, bone remodeling, nonaxial loading, and bruxism.^{2,10,11} A wider base on an implant has been said to be a possible benefit to prevent screw loosening using nonclinical analyses.¹² It has also been suggested by manufacturers that the use of torque drivers should minimize or prevent this screw loosening. Vogel and Davliakos¹³ have recently reported that there was no screw loosening from 3 to 54 months when the Spline implant and prosthetic components (Centerpulse Dental Division, Carisbad, CA) were used. The purpose of this prospective study was to longitudinally compare the frequency of screw loosening in standard diameter, (3.75 and 4.0 mm) implant prostheses to that of wide diameter, (5.0 and 6.0 mm) implant prostheses that have been hand torqued, and to see if using a torque driver could prevent, or minimize, the reoccurrence of this loosening.

MATERIALS AND METHODS

A total of 213 dental implants (Implant Innovations Inc, West Palm Beach, FL, USA) were placed since 1993 in 106 patients for this prospective study at the Ashman Department of Implant Dentistry at New York University College of Dentistry. Of the patients 56 were female and 50 were male with ages ranging from 20 to 74 years old. All implants were externally hexed machined-surface titanium screws. Of the implants 68 were wide diameter and 145 were standard diameter implants. There were 39 single tooth replacements. Of these 13 were wide diameter and located in the posterior maxilla/mandible. Twenty-six were standard diameter and were located in the anterior maxilla, replacing teeth between the canines. There were 68 multiple unit (2-5 units) fixed implant supported partial dentures attached to 174 implants. All of these implants replaced teeth in the posterior maxilla/mandible sextants. All restorations were fabricated using UCLA-type or conical abutments. A total of 63 conical abut-

ments and 150 UCLA-type abutments were used. The conical abutments used an occlusal screw (catalog #GSH30) to attach the prostheses to the conical abutment, and the UCLA-type abutment used an abutment screw (catalog #UNIHT) to attach the prostheses directly to the implants. The prostheses did not contain cantilevered pontics. All prostheses were screw retained, hand tightened at insertion, and supervised by one investigator (PS). The patients were recalled at 3, 6, 12, 24, 36, 48 and 60 months. During the follow-up visits, the prostheses, abutment screws, and occlusal screws were clinically and radiographically evaluated for loosening. When screw loosening occurred, the screws were retightened with a torque driver to 10 Ncm for small occlusal screws (as used to secure prostheses to conical abutments), and to 20 Ncm for the abutment screws (as used to secure UCLA-type abutment prostheses to the implants), as recommended by the manufacturer of the screws used.

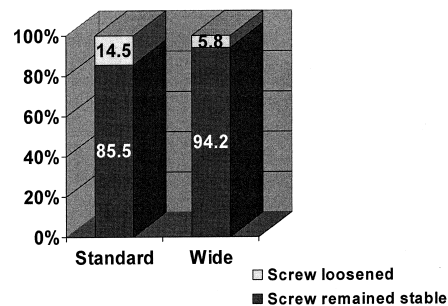
RESULTS

Statistical analyses were performed, and the percentage of screw loosening for different subgroups was evaluated. The categories evaluated were wide vs. standard diameter implants, anterior vs. posterior implants, single tooth replacement vs. multiple unit frameworks, and conical vs. UCLA-type abutments.

Overall, screw loosening occurred in 11.7% (24/213), with an average of 3.2 years time elapsed from prosthesis insertion to screw loosening. Wide diameter implants showed 5.8% (4/68) screw loosening, while standard diameter implants showed 14.5% (21/145) screw loosening (Table 1, Fig. 1). Anterior implants showed 7.7% (2/26)

Table 2. Screw loosening in anterior implants vs posterior implants

	Total	No. of Screws Loosened	% of Screw Loosening
Anterior implants	26	2	7.7
Posterior implants	187	23	12.3

**Fig. 1.** Incidence of screw loosening in wide and standard diameter implants with hand torque alone.

screw loosening, while posterior implants showed 12.3% (23/187) (Table 2). Single tooth replacement prostheses showed 10.3% (4/39), while multiple unit prostheses showed 12.1% (21/174) (Table 3). Of the 39 single implant restorations 9% (2/22) anterior restorations loosened and 11.8% (2/17) posterior restoration loosened (Table 4). Finally, prostheses secured to conical abutments showed 12.6% (8/63), while UCLA-type abutments showed 11.3% (17/150) (Table 5). As screws loosened after the initial prostheses insertion, torque drivers were used to tighten the screws to 10 or 20 Ncm, as recommended by the manufacturer. Since this tightening with the same components, there have been no recurrences in screw loosening after each case for three to five years.

DISCUSSION

Although wide diameter implants were introduced as bail-out implants, their theoretical advantages have been well documented in the literature.¹⁴ Graves et al¹² reported a decrease of the force on a screw of 20%, and 33% when the diameter of an implant was increased from 3.75 mm to 5.0 mm, and 6.0 mm respectively. They postulated that this might indeed reduce the amount of screw loosening. Clearly this clinical investigation supports this hypothesis, with only 5.8% of wide diameter implant supported restorations becoming loose as compared to

Table 3. Screw loosening in single implants vs multiple implants

	Total	No. of Screws Loosened	% of Screw Loosening
Single implants	39	4	10.3
Multiple implants	174	21	12.1

Table 4. Screw loosening in single anterior restorations vs single posterior restorations

	Total	No. of screws Loosened	% of Screw Loosening
Single anterior restorations	22	2	9
Single posterior restorations	17	2	11.8

Table 5. Screw loosening in conical abutment vs UCLA abutment

	Total	No. of Screws Loosened	% of Screw Loosening
Conical abutment	63	8	12.6
UCLA abutment	150	17	11.3

14.5% of standard diameter implant-supported restorations becoming loose (a difference of 8.7%). What is also important is the fact that once these same components were tightened with a torque driver, no further loosening occurred. No wobble or rotation was detected clinically after being torqued. The other significant discrepancy was the difference in loosening between anterior and posterior implants. This discrepancy was 4.6%. Posterior implants loosened at a higher percentage than anterior implants. This supports the concept of eliminating unnecessary occlusal and off-axial forces on implant supported restorations.

To reduce the incidence of screw loosening, clinical research has supported the following clinical recommendations: a) insure implants are placed perpendicular to the occlusal plane; b) frameworks should have minimal cantilever lengths; c) use components with low tolerance levels for component misfit; and d) use components with anti-rotational features for single tooth restorations. One study also showed that the inclusion of a conical spring washer increased the amount of rotational displacement needed to completely loosen an implant screw.¹⁵ In addition, the literature supports a gold alloy screw with a flat head, internal hex or square, and a high tightening force (torque driver), as having the greatest ability to produce the best results.

CONCLUSION

Based on the results of this investigation, the wide diameter implant used in this study reduced the incidence of screw loosening. This investigation also supports the clinical practice of meticulous attention to occlusal forces on implant prostheses. Finally, the use of a torque driver, specific for the type of screw used in this study minimized or prevented screw loosening.

Disclosure

The authors claim to have no financial interest in any company or any of the products mentioned in this article.

REFERENCES

- Zarb G, Schmitt A. The longitudinal clinical effectiveness of osseointegrated dental implants: the Toronto study. Part III: problems and complications encountered. *J Prosthet Dent.* 1990;64:185-194.
- Goodacre CJ, Kan JYK, Rungcharassaeng K. Clinical complications of osseointegrated implants. *J Prosthet Dent.* 1999;81:537-552.
- Jemt T, Book K, Linden B, et al. Failures and complications in 92 consecutively inserted overdentures supported by Brånemark implants in severely resorbed edentulous maxillae: a study from prosthetic treatment to first annual check-up. *Int J Oral Maxillofac Implants.* 1992;7:162-167.
- Naert I, Quirynen M, van Steenberghe D, et al. A study of 589 consecutive implants supporting complete fixed pros-

theses. Part II: prosthetic aspects. *J Prosthet Dent.* 1992;68:949-956.

5. Kallus T, Bessing C. Loose gold screws frequently occur in full-arch fixed prostheses supported by osseointegrated implants after 5 years. *Int J Oral Maxillofac Implants.* 1994;9:169-178.

6. Jemt T, Laney WR, Harris D, et al. Osseointegrated implants for single tooth replacement: a 1-year report from a multicenter prospective study. *Int J Oral Maxillofac Implants.* 1991;6:29-36.

7. Becker W, Becker BE. Replacement of maxillary and mandibular molars with single endosseous implant restorations: a retrospective study. *J Prosthet Dent.* 1995;74:51-55.

8. Lazzara R, Siddiqui AA, Binon P, et al. Retrospective multicenter analysis of 31 endosseous dental implants placed over a five-year period. *Clin Oral Implants Res.* 1996;7:73-83.

9. Binon P. Evaluation of the effectiveness of a technique to prevent screw-loosening. *J Prosthet Dent.* 1998;79:430-432.

10. McGlumphy E, Mendel D, Holloway J. Implant screw mechanics. *Dent Clin North Am.* 1998;42:71-89.

11. Hurson S. Laboratory techniques to prevent screw-loosening on dental implants. *J Dent Technology.* 1996;13:30-37.

12. Graves SL, Jansen CE, Saddiqui AA, et al. Wide diameter implants: indications, considerations and preliminary results over a two-year period. *Aust Prosth J.* 1994;8:31-37.

13. Vogel RE, Davliakos JP. Spline(TM) implant prospective multicenter study: interim report on prosthetic screw stability in partially edentulous patients. *J Esthetic Dent.* 2002;14:225-237.

14. Langer B, Langer L, Herrmann I, et al. The wide fixture: a solution for special situations and a rescue for the compromised implant. *Int J Oral Maxillofac Implants.* 1993;8:400-408.

15. Aboyoussuf H, Weiner S, Ehrenberg D. Effect of an antirotation resistance form on screw-loosening for single implant-supported crowns. *J Prosthet Dent.* 2000;83:450-455.

Reprint requests and correspondence to:
Dennis Tarnow, DDS
c/o NYU College of Dentistry
Department of Implant Dentistry
345 East 24th Street, Rm 8W
New York, NY 10010
Tel: 212-998-9525
Fax: 212-995-4337
E-mail: dpt1@nyu.edu

AUTOR(EN): Sang-Choon Cho, DDS*, Paula-Naomi Small, DDS, MPH**, Nicolas Elian, DDS***, Dennis Tarnow, DDS****.
 *Klinischer Assistenzprofessor, Abteilung für Implantatgestützte Zahnheilkunde, Universität von New York, Zahnmedizinische Fakultät, New York, New York. **Klinischer A.O. Professor, Abteilung für Implantatgestützte Zahnheilkunde, Universität von New York, Zahnmedizinische Fakultät, New York, New York. ***Assistenzprofessor, Leiter des Internationalen Implantationsprogramms, Abteilung für Implantatgestützte Zahnheilkunde, Universität von New York, Zahnmedizinische Fakultät, New York, New York. ****Professor, Vorsitzender, Abteilung für Implantatgestützte Zahnheilkunde, Universität von New York, Zahnmedizinische Fakultät, New York, New York. Schriftverkehr: Dennis Tarnow, DDS, c/o NYU College of Dentistry (zahnmedizinische Fakultät der Universität von New York), Dept. of Implant Dentistry (Abteilung für Implantatgestützte Zahnheilkunde), 345 East 24th Street Rm 8W, New York 10010. Telefon: 212-998-9525, Fax: 212-995-4337. eMail: dpt1@nyu.edu

AUTOR(ES): Sang-Choon Cho, DDS*, Paula-Naomi Small, DDS, MPH**, Nicolas Elian, DDS***, Dennis Tarnow, DDS****.
 *Profesor Asistente Clínico, Departamento de Odontología de Implantes, New York University, Colegio de Odontología, Nueva York, Nueva York. **Profesor Asistente Clínico, Departamento de Odontología de Implantes, New York University, Colegio de Odontología, Nueva York, Nueva York. ***Profesor Asistente, Director del Programa Internacional de Implantes, Departamento de Odontología de Implantes, New York University, Colegio de Odontología, Nueva York, Nueva York. ****Profesor, Jefe, Departamento de Odontología de Implantes, New York University, Colegio de Odontología, Nueva York, Nueva York. Correspondencia a: Dennis Tarnow, DDS, c/o NYU College of Dentistry, Dept. of Implant Dentistry, 345 East 24th Street, Rm 8W, New York, NY 10010. 4 Teléfono: 212-998-9525, Fax: 212-995-4337. Correo electrónico: dpt1@nyu.edu

Schraubenlockerung bei Implantaten mit Standard- und erweitertem Durchmesser: Longitudinalangaben anhand 3 bis 7 Jahre andauernden Studien an teilweise zahnlosen Patienten

ZUSAMMENFASSUNG: Die Lockerung der Schrauben bei Implantationsbehandlungen ist inzwischen als allgemeines Problem bei Wiederherstellungsbehandlungen durch sowohl rein Schraubenfixierte wie auch einzementierte Zahnimplantate anerkannt. Dieses Phänomen könnte durch den Einsatz einer breiteren Stützzahnplattform oder die Verwendung eines Drehmomentverstärkers zur Befestigung speziell ausgelegter Schrauben vermieden werden. Allerdings befasste sich bislang keine klinische Studie mit diesen Möglichkeiten. **Zielsetzung:** Das Ausmaß an Lockerung in der Longitudinalachse soll in einem Vergleich von Implantatgestützten Prothesen mit Standarddurchmesser (3.75 mm und 4.0 mm) zu Implantationslösungen mit großem Durchmesser (5.0 mm und 6.0 mm) bei Befestigung per Hand ermittelt werden. Des Weiteren ist zu untersuchen, inwieweit der Einsatz eines Drehmomentverstärkers bei bereits vorliegender Schraubenlockerung das Problem vermeiden oder zumindest eingrenzen bzw. beseitigen kann. **Materialien und Methoden:** An dieser abschätzenden Longitudinalstudie nahmen 106 Patienten teil. Insgesamt standen 230 Zahnimplantate zur Untersuchung zur Verfügung, davon waren 68 Implantate mit großem Durchmesser und 145 wiesen einen Standarddurchmesser auf. **Ergebnisse:** Die Implantate mit großem Durchmesser wiesen eine Schraubenlockerungsrate von 5.8% auf. Die Implantate mit Standarddurchmesser dagegen mussten 14.5% Anteil an Schraubenlockerung verzeichnen. Bei beiden Optionen wurde das Implantat durch händisches Drehen eingebracht und befestigt. Wurden bereits lockere Verschraubungen mittels Drehmomentverstärker angezogen, kam es zu keinen weiteren Lockerungen. **Schlussfolgerung:** Innerhalb der natürlichen Grenzen der vorliegenden Studie wiesen bei Handverschraubung die Zahnimplantate mit breiterem Durchmesser einen geringeren Anteil an Schraubenlockerungen auf als die mit einem Standarddurchmesser. Weiterhin hat sich als ein Ergebnis dieser Studie ergeben, dass die Verwendung eines Drehmomentverstärkers zum Anziehen der bereits lockeren Schrauben unter Aufwendung der empfohlenen Drehstärke eine weitere Lockerung in allen behandelten Fällen vermeiden konnte.

SCHLÜSSELWÖRTER: Drehmoment, Implantat mit erweitertem Durchmesser, Stützzahn, Schraube

El aflojamiento de tornillos en implantes estándar y de diámetro ancho en casos parcialmente edentulosos: Datos longitudinales de 3 a 7 años

ABSTRACTO: El aflojamiento de tornillos se considera un problema común en la restauraciones con implantes pegados con cementos y retenidos con tornillos. Una plataforma de pilar más amplia así como el uso de un impulsor de torsión para apretar tornillos específicamente indicados podría ayudar a prevenir el aflojamiento. Sin embargo, no hay estudios clínicos que evalúen uno de estos métodos. **Propósito:** Para comparar longitudinalmente la frecuencia del aflojamiento de tornillos en prótesis apoyadas por implantes de diámetro estándar (3.75 mm y 4.00 mm) con los prótesis apoyadas por implantes de diámetro ancho (5.0 mm y 6.00 mm) que fueron ajustados a mano y para evaluar si un impulsor de torsión reduciría o prevendría este problema, si ocurrió el aflojamiento del tornillo. **Material y métodos:** Se incluyeron doscientos trece implantes dentales en ciento seis pacientes en este estudio prospectivo longitudinal. Sesenta y ocho implantes fueron de diámetro ancho y ciento cuarenta y cinco fueron implantes de diámetro estándar. **Resultados:** Los implantes de diámetro ancho demostraron un aflojamiento del tornillo de 5.8%, mientras que los implantes de diámetro estándar demostraron un aflojamiento del tornillo de 14.5% luego de la colocación con la torsión manual. Cuando los tornillos fueron apretados con un impulsor de torsión, desapareció el aflojamiento del tornillo. **Conclusión:** Dentro de las limitaciones de este estudio, los implantes de diámetro ancho probados demostraron menor aflojamiento del tornillo que los implantes de diámetro estándar cuando fueron apretados con la mano. Además, dentro del alcance de nuestro estudio, usar un impulsor de torsión para apretar los tornillos con la fuerza recomendada previno que volviera a ocurrir este aflojamiento en todos los casos.

PALABRAS CLAVES: torsión, implante de diámetro ancho, pilar, tornillo

AUTOR(ES): Sang-Choon Cho, Cirurgião-Dentista*, Paula-Naomi Small, Cirurgião-Dentista, Mestre em Saúde Pública**, Nicolas Elian, Cirurgião-Dentista***, Dennis Tarnow, Cirurgião-Dentista****. *Professor-Assistente Clínico, Departamento de Odontologia de Implantes, Universidade de Nova York, College of Dentistry, Nova York, Nova York. **Professor Associado Clínico, Departamento de Odontologia de Implantes, Universidade de Nova York, College of Dentistry, Nova York, Nova York. ***Professor Assistente, Diretor do Programa Internacional de Implantes, Departamento de Odontologia de Implantes, Universidade de Nova York, College of Dentistry, Nova York, Nova York. ****Professor, Presidente, Departamento de Odontologia de Implantes, Universidade de Nova York, College of Dentistry, Nova York, Nova York. Correspondência para: Dennis Tarnow, DDS, c/o NYU, College of Dentistry, Dept. of Implant Dentistry, 345 East 24th Street Rm 8W, New York, NY 10010. Telefone.: 212-998-9525, Fax: 212-995-4337. E-mail: dpt1@nyu.edu

Afrouxamento de Parafuso para Implantes-Padrão e de Diâmetro Largo em Casos Parcialmente Desdentados: Dados Longitudinais de 3 a 7 Anos

RESUMO: O afrouxamento de parafuso é considerado um problema comum nas restaurações retidas por parafuso e nos implantes cimentados. Uma plataforma de suporte mais largo, bem como usar uma chave de torque para apertar parafusos especificamente projetados podem ajudar a prevenir esse afrouxamento. Contudo, não houve nenhum estudo clínico avaliando qualquer desses. **Propósito:** Para comparar longitudinalmente a frequência de afrouxamento de parafuso em diâmetro-padrão, o implante de (3.75 e 4.0 mm) suportou próteses àquele de diâmetro largo, o implante de (5.0 e 6.0 mm) suportou próteses que foram apertadas a mão, e para avaliar se usar uma chave de torque minimizaria ou preveniria esse problema, se o afrouxamento de parafuso ocorresse. **Material e métodos:** Duzentos e treze implantes dentários em cento e seis pacientes foram incluídos neste estudo longitudinal em perspectiva. Sessenta e oito implantes eram de diâmetro largo e cento e quarenta e cinco eram implantes de diâmetro-padrão. **Resultados:** Os implantes de diâmetro largo mostraram afrouxamento de parafuso de 5.8%, enquanto os implantes de diâmetro-padrão mostraram afrouxamento de parafuso de 14.5% após a inserção com apenas um torque manual. Quando esses parafusos soltos foram apertados com uma chave de torque, não houve mais afrouxamento de parafusos. **Conclusão:** Dentro das limitações deste estudo, os implantes de diâmetro largo testados mostrados menos afrouxamento de parafuso do que os implantes de diâmetro-padrão quando torcidos a mão. Adicionalmente, dentro do escopo de nosso estudo, usar uma chave de torque para apertar os parafusos com a força recomendada impediu que esse afrouxamento ocorresse em todos os casos.

PALAVRAS-CHAVE: torque, implante de diâmetro largo, suporte, parafuso.

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部分無菌の症例における標準型ならびに直径の大きいインプラントのスクリューの緩みについて；3～7年間の長期的データ

著者：サン・チューン・チョー、DDS*、ポーラ・ネオミ・スモール、DDS、MPH**、ニコラス・エリアン、DDS**、デニス・ターノー、DDS****

要約：スクリューの緩みは、スクリュー固定型ならびにセメント固定型の両者のインプラントにしばしば観察される問題である。より広いアバットメント・プラットフォームと、個別にデザインされたスクリューのトルクドライバーによる締め付けは、この問題の予防措置として効果がある。しかしこれらの措置の臨床的評価はこれまでには行われていなかった。

目的：手で締め付けられた標準的直径（3.75 mm、4.0mm）のインプラント支持の補綴と直径の大きい（5.0mm、6.0mm）インプラント支持の補綴における長期的なスクリューの緩みの頻度を比較し、トルクドライバーの使用がスクリューの緩みの問題を部分的または完全に予防させることができるかどうかを評価すること。

素材と方法：106人の患者の213個のインプラントがこの長期的研究の対象として選択された。うち61人が直径の大きいインプラントの症例であり、145人が標準的な直径のインプラントの症例である。

結果：手だけによる挿入後、直径の大きいインプラントの症例ではスクリューの緩みが起こる頻度は5.8%で、標準的な直径のインプラントの症例では同じく14.5%だった。これらのスクリューがトルクドライバーで締め付けられた後には、スクリューの緩みはまったく起こらなかった。

結論：本研究の範囲において、手だけでトルクを加えた場合には、直径の大きいインプラントで標準的な直径のインプラントより少ない頻度でスクリューの緩みが見られた。さらに本研究では、トルクドライバーでスクリューを指定の圧力に締め付けた場合にはすべての症例で緩みの再発が予防できることがわかった。

キーワード：トルク、直径の大きいインプラント、アバットメント、スクリュー

*ニューヨーク大学カレッジ・オブ・デンティストリー、インプラント歯科学部臨床助教授（ニューヨーク州ニューヨーク）

**ニューヨーク大学カレッジ・オブ・デンティストリー、インプラント歯科学部臨床准教授（ニューヨーク州ニューヨーク）

***ニューヨーク大学カレッジ・オブ・デンティストリー、インプラント歯科学部国際インプラントプログラム主任、助教授（ニューヨーク州ニューヨーク）

****ニューヨーク大学カレッジ・オブ・デンティストリー、インプラント歯科学部長、教授（ニューヨーク州ニューヨーク）

問い合わせ先：Dennis Tarnow, DDS, C/o NYU College of Dentistry, Dept. of Implant Dentistry, 345 East 24th Street Rm 8W, New York, NY 10010

電話：212-998-9525 ファックス：212-995-4337 メール：dptl@nyu.edu