Influence of Abutment Design on Clinical Status of Peri-Implant Tissues

Tara B. Taiyeb-Ali, BDS, MSc,* Chooi Gait Toh, BDS, MSc;† Chong Huat Siar, BDS, MSc,* Doris Seiz, DDS;‡ and Siew Tin Ong, BDS§

The Ankylos system (Friadent GmbH, Mannheim, Germany) developed in 1985 has been in clinical use since 1987. The progressive thread design of the screw-implant fixture provides optimal load transmission toward the resilient trabecular bone, which can absorb more functional stress. The tapered connector (Fig. 1) eliminates microgaps between the abutment and the fixture observed in butt-joint connections (Fig. 2) of many 2-stage implant systems, in an attempt to reduce the risk of infection. The precisely machined Morse taper in the abutment also prevents abutment rotation.

In 2-stage implant designs, a small microgap of 1 to 10 µm has been reported to be present between the implant fixture and the abutment. This microgap has even been reported to be as high as 40 to 60 µm, which will allow the accumulation of food debris and bacteria that cause localized inflammation with subsequent crestal bone loss. In addition, this microgap may allow micromovement between the parts during clinical function, both of which can lead to localized inflammation and crestal bone loss.

**Objective:** To compare the clinical soft tissue responses around implant tooth-supported 3-unit bridges using tapered abutments with those using butt-joint abutments.

**Methods:** In a split-mouth design study, 8 mm Ankylos (Dentsply Friadent, Germany) implants were placed in the second mandibular molar region of 8 adult Macaca fascicularis monkeys about 1 month after extraction of all mandibular molars. After 3 months of submerged healing, 3-unit metal bridges were constructed. Clinical data was collected by the author who was blind to the abutment selections. Implants were clinically evaluated using Waite plaque index, sulcus bleeding index, probing pocket depth (PPD), probing attachment loss (PAL), and width of keratinized mucosa at baseline (BL) and 3-month and 6-month intervals. Stability of the implant was assessed using Periotest device at BL and after 6 months.

**Results:** At BL, all the clinical variables did not differ statistically between the tapered and the butt-joint groups except for PPD (P < 0.05), where the mean PPD was greater in the butt-joint group (2.75 ± 1.02 mm) as compared with the tapered group (1.97 ± 0.65 mm). At the 3-month assessment, there was no difference in all clinical variables. After 6-month loading, no significant difference between these 2 groups was detected in all these variables, with the exception of PAL (P = 0.05) where mean PAL was greater for implants with the butt-joint abutments (0.91 ± 0.86 mm) in comparison with the tapered abutments (0.50 ± 0.88 mm), and mean Periotest values (PTVs) that indicate the tapered-abutment implants (PTV = −4.5 ± 1.60) were more stable than butt-joint-abutment implants (PTV = −1.5 ± 3.59) with P < 0.05.

**Conclusions:** The differences in these mucogingival responses between these 2 groups at BL (during seating of abutments, especially of butt-joint abutments) and after 6-month loading indicated enhanced peri-implant soft tissue stability around the tapered abutments of this system. There was also enhanced-PTV in the test group for clinical mobility assessment after 6-month loading. (Implant Dent 2009;18:438–446)

**Key Words:** monkeys, tapered-joint abutment, butt-joint abutment, platform switching, 3-unit bridges

To improve this limitation, Nentwig and Morse invented this innovative design in the Ankylos implant system. This Morse taper in the tapered connector was investigated in Macaque monkeys at the University of Malaya Animal Research Center. A collaborative prospective multidisciplinary trial was conducted with the University of Frankfurt and Dentsply Friadent GmbH (Mannheim, Germany).

The objective of this study was (i) to compare the clinical soft tissue responses around implant tooth-supported 3-unit bridges using the...
tapered abutments with those using butt-joint abutments; and ii) to compare implant stability after 6-month interval in both these abutments.

**MATERIALS AND METHODS**

The collaborative groups developed the study protocol. The protocol was reviewed and accepted by the Research Ethics Committee, University of Malaya (Ethics Reference No. U1/10/6/1996/TCG-4).

In a split-mouth design study, 8 mm Ankylos (Dentsply Friadent, Germany) implants were placed in the second mandibular molar region of 8 adult *Macaca fascicularis* monkeys about 1 month after extraction of all mandibular molars. After 3 months of submerged healing, 3-unit metal bridges were constructed with second premolar as natural tooth abutment, first molar as pontic and the implants connected with a tapered abutment on one side and, a butt-joint abutment on the contralateral side by random selection.

In this study, the first author, who was blind to these abutment selections, collected the clinical data. Implants were clinically evaluated using Waite plaque index, sulcus bleeding index (SBI), probing pocket depth (PPD), probing attachment loss (PAL), and width of keratinized mucosa at baseline (BL) and 3-month and 6-month intervals. Stability of the implant was assessed using Periotest equipment at BL and after 6 months. The Periotest device (Siemens AG, Bensheim, Germany) provides a measure of the stability of the bone-implant complex as well as implant-abutment interface as Periotest values (PTVs). The bridges were deconstructed before mobility assessment and each implant was assessed individually.

**RESULTS**

In Table 1, at BL, all the clinical variables did not differ significantly between the tapered- and butt-joint-abutments groups with the exception of PPD ($P < 0.001$), being greater in the butt-joint group ($2.75 \pm 1.02$ mm) as compared with the tapered group ($1.97 \pm 0.65$ mm), using nonparametric methods (Mann-Whitney U Test). The mean SBI values in this group were also higher but not significantly.

In Table 2, at the 3-month assessment, the mean values for plaque index, SBI, PPD, and relative PAL were greater in the butt-joint group as compared with the tapered group, although there was no significant difference when controlled for BL values.

After 6-month loading (Table 3), no significant difference between these 2 groups was detected in all these variables when controlled for BL values, with the exception of PAL ($P = 0.05$) where the mean PAL was greater for implants with the butt-joint abutments ($0.91 \pm 0.86$ mm) in comparison with the tapered abutments ($0.50 \pm 0.88$ mm).

Table 4 shows the mean PTVs. At BL, the mean PTVs of $5.0 \pm 1.51$ for the tapered abutment and $3.5 \pm 1.31$ for the butt-joint abutments indicate these implants and connections are stable, although the stability is greater for the tapered abutments ($P < 0.05$). After 6-month loading, the mean PTVs indicate again that the tapered-abutment implants (PTV = $4.5 \pm 1.60$) were more stable than the butt-joint-abutment implants (PTV = $1.5 \pm 3.59$) with $P < 0.05$.

In Tables 5 and 6, the range and distribution of PTVs at BL and after 6-month interval are shown, respectively. The PTVs at BL are within a normal range of implant stability but at the 6-month interval, a couple of...
Table 1. Comparison of Means ± SD of All Clinical Parameters at Baseline Using Mann Whitney Test

| Variables | Tapered Means ± SD | Butt-Joint Means ± SD | F     | P Value |
|-----------|--------------------|------------------------|-------|---------|
| PS        | 0.91 ± 0.53        | 0.84 ± 0.52            | 0.23  | P = 0.63 |
| SBI       | 1.16 ± 0.57        | 1.34 ± 0.55            | 1.79  | P = 0.19 |
| PPD       | 1.97 ± 0.65        | 2.75 ± 1.02            | 13.46 | P = 0.001* |
| KM        | 1.06 ± 1.29        | 1.44 ± 1.32            | 0.66  | P = 0.42 |
| AL        | 0.53 ± 1.05        | 0.66 ± 1.07            | 0.22  | P = 0.64 |

Table 2. Comparison of Means ± SD/SE of All Clinical Parameters at 3 Months Interval Using Mann Whitney Test (Underlined Data Adjusted to BL Values)

| Variables | Tapered Means ± SD | Butt-Joint Means ± SD | F     | P Value |
|-----------|--------------------|------------------------|-------|---------|
| PS        | 1.09 ± 0.59        | 1.16 ± 0.57            | 0.18  | P = 0.67 |
| SBI       | 1.31 ± 0.59        | 1.56 ± 0.56            | 2.99  | P = 0.09 |
| PPD       | 2.94 ± 0.18(SE)    | 2.91 ± 0.18(SE)        | 0.01  | P = 0.92 |
| KM        | 1.37 ± 0.11(SE)    | 1.57 ± 0.11(SE)        | 1.71  | P = 0.20 |
| AL        | 0.44 ± 0.13(SE)    | 0.78 ± 0.13(SE)        | 3.37  | P = 0.07 |

Table 3. Comparison of Means ± SD/SE of All Clinical Parameters at 6 Months Interval Using Mann Whitney Test (Underlined Data Adjusted to BL Values)

| Variables | Tapered Means ± SD | Butt-Joint Means ± SD | F     | P Value |
|-----------|--------------------|------------------------|-------|---------|
| PS        | 1.16 ± 0.68        | 1.16 ± 0.63            | 0     | P = 1.00 |
| SBI       | 1.38 ± 0.61        | 1.63 ± 0.65            | 2.95  | P = 0.09 |
| PPD       | 2.86 ± 0.18(SE)    | 2.80 ± 0.18(SE)        | 0.06  | P = 0.81 |
| KM        | 1.37 ± 0.13(SE)    | 1.57 ± 0.13(SE)        | 1.23  | P = 0.28 |
| AL        | 0.53 ± 0.12(SE)    | 0.88 ± 0.12(SE)        | 3.89  | P = 0.05* |

Table 4. Comparison of Means of PTVs at Baseline & 6 Months Using Independent Samples T-test

| Time Interval | Tapered Means ± SD | Butt-Joint Means ± SD | F     | P Value |
|---------------|--------------------|------------------------|-------|---------|
| Baseline      | −5.00 ± 1.51       | −3.50 ± 1.31           | 4.50  | P = 0.052 |
| 6-months      | −4.50 ± 1.60       | −1.50 ± 3.59           | 4.67  | P = 0.049* |

Table 5. Range & Distribution of PTVs at Baseline

| Abutment type | −1 | −2 | −3 | −4 | −5 | −6 | −8 |
|---------------|----|----|----|----|----|----|----|
| Tapered (n)   | 0  | 0  | 1  | 2  | 3  | 1  | 1  |
| Butt-Joint (n)| 1  | 1  | 0  | 5  | 1  | 0  | 0  |

Table 6. Distribution of PTVs at 6-Months Interval

| Abutment type | +5 | +3 | −2 | −3 | −4 | −5 | −6 | −7 |
|---------------|----|----|----|----|----|----|----|----|
| Tapered (n)   | 0  | 0  | 3  | 2  | 0  | 2  | 1  |    |
| Butt-Joint (n)| 1  | 1  | 2  | 1  | 1  | 0  | 0  |    |

Butt-joint-abutment implants have PTV of +3 and +5, which may indicate decreased stability.

**DISCUSSION**

Ankylos implant is a grade 2 titanium-tapered screw with a roughened surface. The thread design progresses in depth apically to direct the functional load to the trabecular bone over the length of the implant. The inner aspect of the top of the implant fixture has a conical taper that permits secure seating of the prosthetic abutment.2 The precision fit of the tapered abutment within the implant prevents abutment loosening and rotation of the abutment. Broader, tighter connective tissue cuff adjacent to the tapered abutment plays a role in effecting an optimal seal between oral environment and peri-implant bone.

The conical connector is believed to produce an accurate and tight fit presumably resulting in unimpeded apposition, increased volume and stability of soft tissue, and reduced risk of infection because of the absence of microgaps. However, evidence-based reports are needed to support this contention of the tapered abutments of implants during prosthetic rehabilitation. Parameters advocated to assess peri-implant health status include plaque, mucosal conditions, PPD, width of keratinized mucosa, suppuration, implant mobility, and radiographic evaluation.14,15

In this study, at BL, the PPD is greater at the butt-joint abutments possibly because of the highly invasive 2nd stage surgery and by virtue of seating these abutments after soft tissue and sometimes hard tissue manipulation.16 The tissue reactions or damage initiated at the butt joints as well as the microleakage at the microgap of the abutment-implant interface with resultant inflammation (higher SBI scores and PPD) at 3-month and 6-month intervals could have culminated in the greater relative PAL observed after 6 months.16 Gross et al7 also noted inflammatory responses in all 5 implant systems with butt-joints investigated as a result of the microleakage. The parameter of relative PAL is a good predictor for peri-

---

*P ≤ 0.05.
implant tissue status for long-term assessments.18 Assessments of relative PAL (loss of connective tissue adhesion to the abutment and implant surface) renders information on peri-implant tissue alterations that can be closely correlated to radiographic peri-implant bone changes.18,19 This correlation will be investigated in future analysis of the data.

With respect to stability at the bone-implant interface and implant-abutment interface, at the 6-month interval, the stability was more apparent as indicated in Tables 4–6. This may indicate a tighter fit at the tapered abutments20 and possible micromovements at the microgaps in butt-joints, which may be ultimately accompanied with crestal bone loss around these implants. Lingual swelling and hematoma in one of the monkeys was observed after 2nd stage surgery, which would have affected the clinical recordings as a small number of implants were used (as this was an animal study). This complication occurred around a tapered-abutment implant. No other complications or pathoses were observed in this study.

CONCLUSIONS

1. The differences in the mucogingival responses between the implant group using internal tapered conical abutment connection (test group) and those using butt-joint-abutment connection (control group) at BL (i.e., during seating of abutments, especially of butt-joint abutments) and after 6 months indicated enhanced peri-implant soft tissue stability around the tapered abutments of this system.

2. Under dynamic natural loading, there was probably greater implant stability (as reflected by PTVs) in the test group for tapered connection of this system for clinical mobility assessment after 6-month loading.

Disclosure

The authors do not have any financial interests, either directly or indirectly, in the products or information listed in the article.

ACKNOWLEDGMENTS

This study was supported by R&D IRPA Vote No. 40-02-03-0002; and Dentsply Friadent, Germany.

REFERENCES

1. Jansen VK, Conrad G, Richter EJ. Microbial leakage and marginal fit of the implant-abutment interface. Int J Maxillofac Implant. 1997;12:527-540.
2. Norton MR. An in vitro evaluation of the strength of an internal conical interface compared to a butt joint interface in implant design. Clin Oral Implant Res. 1997;8:290-298.
3. Tsuge T, Hagiwara Y, Matsumura H. Marginal fit and microgaps of implant-abutment interface with internal anti-rotation configuration. Dent Mater J. 2008;27:29-34.
4. Scarano A, Assenza B, Piattelli M, et al. A 16-year study of the microgap between 272 human titanium implants and their abutments. J Oral Implantol. 2005;31:269-275.
5. Steinebrunner L, Wolfart S, Bößmann K, et al. In vitro evaluation of bacterial leakage along the implant-abutment interface of different implant systems. Int J Maxillofac Implants. 2005;20:875-881.
6. Hermann JS, Schoofield JD, Schenk RK, et al. Influence of the size of the microgap on crestal bone changes around titanium implants. A histometric evaluation of unloaded non-submerged implants in the canine mandible. J Periodontol. 2001;72:1372-1383.
7. Engelke W, Decco OA, Rau MJ, et al. In vitro evaluation of horizontal implant micromovement in bone specimen with contact endoscopy. Implant Dent. 2004;13:88-94.
8. Norton MR. Understanding the intimate relationship between biomechanics and optimal clinical performance: Application of implant design. Compd Contd Educ Dent. 2002;23(9 suppl):21-25.
9. Morris HF, Ochi S, Winkler S. Introduction: A new and innovative implant design. J Oral Implantol. 2004;30:121-124.
10. Nentwig GH. Ankylos implant system: Concept and clinical application. J Oral Implantol. 2004;30:171-177.
11. Chou CT, Morris HF, Ochi S, et al. AICRG, Part II: Crestal bone loss associated with the Ankylos implant. Loading to 36 months. J Oral Implantol. 2004;30:134-143.
12. Waite IM, Jail R, Cornick DER. A probe for plaque measurement. Dental Practice. 1983;21:1-3.
13. Muhlemann HR, Son S. Gingival sulcus bleeding—A leading symptom in initial gingivitis. Helv Odontol Acta. 1971;15:107-113.
14. Salvi GE, Lang NP. Diagnostic parameters for monitoring peri-implant conditions. Int J Maxillofac Implants. 2004;19:116-127.
15. Lang NP, Berglundt T, Heitz-Mayfield LJ, et al. Consensus statements and recommended clinical procedures regarding implant survival and complications. Int J Maxillofac Implants. 2004;19(suppl):150-154.
16. Abrahamsson I, Berglundt T, Lindhe J. The mucosal barrier following abutment dis/reconnection. An experimental study in dogs. J Clin Periodontol. 1997;24:568-572.
17. Gross M, Abramovich I, Weiss EI. Microleakage at the abutment-implant interface of osseointegrated implants: A comparative study. Int J Oral Maxillofac Implants. 1999;14:99-100.
18. Bragger U, Hugel-Pisoni C, Bürgin W, et al. Correlations between radiographic, clinical and mobility parameters after loading of oral implants with fixed partial dentures. A 2-year longitudinal study. Oral Implants Res. 1996;7:230-239.
19. Toh CG, Siar CH, Seiz D, et al. Influence of abutment design on crestal bone in implant-tooth-supported bridges. J Dent Res 2005; Special Issue, Abstract 3287.
20. Morris HF, Winkler S, Ochi S. The ankylosed endosseous dental implant: Assessment of stability up to 18 months with the Periodont. J Oral Implantol. 2000;26:291-299.
Abstract Translations

**GERMAN / DEUTSCH**

**AUTOR(EN):** T. B. Taiyeb-Ali, BDS, MSc, C. G. Toh, BDS, MSc, C. H. Siar, BDS, MSc, D. Seiz, DDS, S. T. Ong, BDS.

**Auswirkungen des Stützapparatdesigns auf den klinischen Status des Gewebes im Umfeld des Implantats**

**ZUSAMMENFASSUNG: Zielsetzung:** Es sollten die klinischen Reaktionen des Weichgewebes im Gewebe um die Implantatgestützten dreiteiligen Brückenkonstruktionen mit kegelförmigen Stützkonstruktionen (T) mit denen verglichen werden, die mit stumpf aneinander gefügten Stützapparaturen (B) arbeiten. **Methoden:** In einer Studie unter Nutzung eines Designs mit aufgeteilter Mundraum wurden 8 mm Implantate des Typs Ankylos® (Dentsply Friadent, Deutschland) in die zweite Molarregion im Unterkiefer von 8 ausgewachsenen Macaca fascicularis-Affen eingepflanzt. Diese Implantierung wurde ungefähr einen Monat nach Extraktion der kompletten Mahlzähne im Unterkiefer vorgenommen. Nach einer Heilungszeit von 3 Monaten in abgedecktem Zustand wurden dreiteilige Brücken aus Metall angefertigt. Die klinischen Daten wurden zusammengestellt, um darüber die Auswahl der Stützkonstruktionen per Zufallsprinzip gestalten zu können. Die Implantate wurden unter Zuhilfenahme des Waite-Plaque-Index (PI), des Sulcus-Blutungs-Index (SBI), der Sondierungstiefe (PTV), des Verlusts der Sondierungsbefestigung (PPI) sowie der Weite der keratinisierten Schleimhaut (KMW) einmal zum Ausgangszeitpunkt, dann nach 3 Monaten und schlussendlich nach 6 Monaten klinisch beurteilt und bewertet. **Ergebnisse:** Zum Ausgangszeitpunkt gab es keine statistischen Unterschiede zwischen den gesamten klinischen Variablen in den Gruppen T und B mit Ausnahme des Wertes für PPI (P < 0.05). Dort war ein höherer PPI-Wert für Testgruppe B (2.75 ± 1.02 mm) im Vergleich zu Gruppe T (1.97 ± 0.65 mm) feststellbar. Bei Beurteilung nach 3 Monaten gab es keinerlei Unterschiede zwischen den gesamten klinischen Variablen. Nach einer Belastung von 6 Monaten wurden ebenfalls keine bedeutsamen Unterschiede zwischen diesen beiden Gruppen festgestellt mit Ausnahme des Wertes für PPI (P = 0.05). Dort war der Wert für die Implantate mit den Stützkonstruktionen der Gruppe B (0.91 ± 0.86 mm) höher als die bei den Stützkonstruktionen der Gruppe T (0.50 ± 0.88 mm). Die durchschnittlichen Periotest-Werte (PTV) wiesen aus, dass die Implantate mit den Stützapparaturen der Gruppe T (PTV = −4.5 ± 1.60) bei einem p < 0.05 stabil sind als die Implantate mit Stützkonstruktionen der Gruppe B (PTV = −1.5 ± 3.59).

**Schlussfolgerungen:** Die Unterschiede in diesen Reaktionen der Zahnfleischschleimhaut zwischen den beiden Gruppen zum Ausgangszeitpunkt (nach dem Setzen der Stützapparaturen, besonders bei den Stützkonstruktionen der Gruppe B) und nach einer 6-monatigen Belastungszeit wiesen eine fortschreitende Stabilität des Weichgewebes im Implantat umlagernden Gewebe um die konisch zulaufenden Stützkonstruktionen dieses Systems auf. Auch wies die Testgruppe in Bezug auf die Bewertung der klinischen Mobilität einen erhöhten PTV-Wert nach einer Belastungszeit von 6 Monaten auf.

**SCHLÜSSELWÖRTER:** Affen, kegelförmig verbundene Stützapparatur, stumpf aneinander gefügte Stützapparatur, dreiteilige Brücken

**SPANISH / ESPAÑOL**

**AUTOR(ES):** T. B. Taiyeb-Ali, BDS, MSc, C. G. Toh, BDS, MSc, C. H. Siar, BDS, MSc, D. Seiz, DDS, S. T. Ong, BDS.

**La influencia del diseño del lindero en el estado clínico de los tejidos perimplante**

**ABSTRACTO: Objectivo:** Comparar las respuestas clínicas del tejido suave alrededor de un puente de 3 unidades apoyado en implantes que utilizan linderos cónicos (T) con los que usan linderos de junta plana (B). **Métodos:** En un estudio de la boca dividida, se colocaron implantes de 8 mm Ankylos® (Dentsply Friadent, Alemania) en la segunda región molar de la mandíbula de 8 monos adultos Macaca fascicularis luego de 1 mes de la extracción de todos los molares de la mandíbula. Luego de 3 meses de curación sumergida, se construyeron puentes de metal de 3 unidades. SE recolectaron los datos clínicos en forma ciega según la selección de lindero. Se evaluaron clínicamente los implantes usando el índice de sarro Waite (PI), índice de sangrado en el sulcus (SBI), determinación de la profundidad de la cavidad (PPI), determinación de la pérdida de unión (PAL), y ancho de la mucosa queratinizada (KMW) en la línea de base, e intervalos de 3 y 6 meses. Se evaluó la estabilidad del implante usando un dispositivo Periotest en la línea de base y después de 6 meses. **Resultados:** En la línea de base todas las variables clínicas no fueron estadísticamente diferentes entre los grupos T y B, excepto PPI (P < 0.05), donde la mediana de PPI fue mayor en el grupo B (2.75 ± 1.02 mm) comparado con el grupo T (1.97 ± 0.65 mm). En la evaluación de los 3 meses, no existió diferencia en todas las variables clínicas. Después de los 6 meses de carga, no se detectaron diferencias significativas entre estos 2 grupos en todas estas variables excepto PAL (P = 0.05) donde la mediana de PAL fue mayor para los implantes con lindero B (0.91 ± 0.86 mm) comparado con los linderos T (0.50 ± 0.88 mm) y los valores de la mediana del Periotest (PTV) que indican que los implantes con lindero T (PTV = −4.5 ± 1.60) son más estables que los implantes con lindero B (PTV = −1.5 ± 3.59) con P < 0.05. **Conclusiones:** Las diferencias en estas
responses mucogingivales entre estos 2 grupos en la línea de base (durante la colocación de los linderos, especialmente los linderos B) y después de los 6 meses de carga indicaron una estabilidad mejorada del tejido suave peri-implante alrededor de los linderos cónicos de este sistema. También se detectó una PTV mejorada en el grupo de prueba de la evaluación clínica de la movilidad después de los 6 meses de carga.

**PALABRAS CLAVES:** monos, linderos cónicos, lindero de junta plana, cambio de plataforma, puentes de 3 unidades

**PORTUGUÊSE / PORTUGUÊS**

**AUTOR(ES):** T. B. Taiyeb-Ali, Bacharel em Cirurgia Dentária, Mestre em Ciência, C. G. Toh, Bacharel em Cirurgia Dentária, Mestre em Ciência, C. H. Siar, Bacharel em Cirurgia Dentária, Mestre em Ciência, D. Seiz, Cirurgião-Dentista, S. T. Ong, Bacharel em Cirurgia Dentária.

**Influência do Projeto de Suportes sobre o Estado Clínico de Tecidos de Peri-implante**

**RESUMO: Objetivo:** Comparar as respostas clínicas do tecido mole em torno de pontes de 3 unidades suportadas por dentes de implante utilizando suportes afunilados (T) com aqueles utilizando suportes de junta de topo (B). **Métodos:** Num estudo de projeto de boca fendida, implantes Ankylos® (Dentsply Friadent, Alemanha) de 8 mm foram colocados na segunda região molar mandibular de 8 macacos Macaca fascicularis adultos cerca de 1 mês após a extração de todos os molares mandibulares. Após 3 meses de cura submersa, 3 pontes de metal de 3 unidades foram construídas. Dados clínicos foram coletados para as seleções de suportes. Os implantes foram avaliados clinicamente usando índice de placa Waite (PI), índice de sangramento do sulco (SBI), profundidade de bolsa de sondagem (PPD), perda de conexão de sondagem (PAL) e largura de mucosa (KMW) em intervalos de linha de base de 3 e 6 meses. A estabilidade do implante foi avaliada usando dispositivo Periotest em linha de base e após 6 meses. **Resultados:** Na linha de base todas as variáveis clínicas não diferiram estatisticamente entre os grupos T e B, exceto para PPD (P < 0.05), onde o PPD médio foi maior no grupo B (2.75 ± 1.02 mm) em comparação com o grupo T (1.97 ± 0.65 mm). Na avaliação de 3 meses, não houve diferença em todas as variáveis clínicas. Após 6 meses de carga, nenhuma diferença significativa entre esses 2 grupos foi detectada em todas essas variáveis com exceção de PAL (P = 0.05), onde o PAL médio foi maior para implantes com suportes B (0.91 ± 0.86 mm) em comparação com suportes T (0.50 ± 0.88 mm) e os valores Periotest médios (PTV) que indicam que os implantes de suporte T (PTV = -4.5 ± 1.60) são mais estáveis do que os implantes de suporte B (PTV = -1.5 ± 3.59) com P < 0.05. **Conclusões:** As diferenças nessas respostas mucogengivais entre esses 2 grupos na linha de base (durante o assentamento dos suportes, especialmente de suportes B) e após 6 meses de carga indi-
Influence of Abutment Design on Peri-Implant Tissues • Taiyeb-Ali et al

444

Influence of Abutment Design on Peri-Implant Tissues

YAZARLAR: T. B. Taiyeb-Ali, BDS, MSc, C. G. Toh, BDS, MSc, C. H. Siar, BDS, MSc, D. Seiz, DDS, S. T. Ong, BDS.

Peri-Implant Dokularının Klinik Statüsünde Abutman Tasarımının Etkisi

ÖZET: Amaç: Bu çalışma, konik (K) abutman veya butt-joint abutman (B) kullanılan, implant edilmiş diş ile desteklenen 3-uniteli protezlerin etrafındaki yumuşak doku stabilitelerindeki değişimlere odaklanmaktadır. Yöntemler: Aşağıdaki bölgelerde (PTD) ölçüldü: bir tasarım sahip bu çalışmadan, 8 yetişkin Macaca fascicularis maymunun tüm mandibüler ağız dişleri çekildiken yaklaşık 1 ay sonra 8 mm’lik Ankylos® (Dentsply Friadent, Germany) implantları, ikinci mandibüler molar bölgesine yerleştirildi. 3 ay boyunca gözlüklü olarak iyileşmenin sonra 3-uniteli metal protezler üretildi. Abutman seçimleri körelmeli olarak klinik veriler kaydedildi. Implantlar basınççığa, 3 ay ve 6 ay sonunda, Waite plak indeksi (PI), sulkus kanama indeksi (SK), proplonan (probing) cep derinliği (PCD), proplonan atış yapan (PAK) ve keratinleşmiş mukoza genişliği (KMG) klinik olarak değerlendirildi. İmplant stabilitesini, basınççığa ve 6 ay sonra Periotest cihazı kullanılarak ölçüldü. Bulgular: Basınççığa, K ve B grupları arasındaki klinik değişkenler istatistiksel açıdan anlamlı bir değişiklik göstermedi. Buna tek istisna 3-aylık değerlendirmede klinik değişkenlerin hiçbirinde bir farklılık gözlemedi. 6-aylık aylık değerlendirmede klinik değişkenlerin hiçbirinde bir fark gözlememedi. 6-aylık aylık değerlendirmede klinik değişkenlerin hiçbirinde bir fark gözlememedi. 6-aylık aylık değerlendirmede klinik değişkenlerin hiçbirinde bir fark gözlemedi.6-aylık aylık değerlendirme süresinden sonra, bu 2 gruba göre klinik değerlendirmelerin istatistiksel açıdan anlamlı bir fark görülmedi. Bu, çok büyük bir risk olduğunu gösterdi. Ortalama PCD değerinin B abutmanlı implantlarda (0.91 ± 0.86 mm), K abutmanlı implantlarda (0.50 ± 0.88 mm) karsın daha yüksek olduğunu gösterdi. Ortalama Periotest değerleri (PTD), K abutmanlı implantlarda (PTD = 0.50 ± 0.50) ve B abutmanlı implantlarda (PTD = 0.65 ± 0.65) arasında istatistiksel olarak anlamlı bir fark meydana geldi (P < 0.05). SONUÇLAR: Bu 2 gruba göre klinik değerlendirimde, özellikle B abutmanlı implantlarda, konik dayanıklı sistemlerin etrafındaki peri-implant yumuşak doku stabilitelerinin artması olduğunu işaret etti. 6-aylık değerlendirmeden sonra yapılan klinik mobilite değerlendirilmesinde Test grubunda artmış PTD izlendi.

ANAHTAR KELİMELER: maymunlar, konik-eklemli abutman, butt-joint abutman, platform değiştirme, 3-uniteli protez
方法：スプリットマウスデザイン研究で、8頭の成体カニクイザル（Macaca fascicularis）の下顎骨全臼歯を抜歯し、その約1ヶ月後に8mm Ankylos®（Dentsply Friadent社、ドイツ）インプラントを下顎骨第二臼歯部位に埋入した。3ヶ月間にわたる粘膜下治療（submerged healing）を経た後、3ユニットメタルブリッジを作成した。臨床データ収集はアプバメントセレクションを識別せずにこなし、インプラントはウェイト（Waite）ブラウン指数（P1）および歯肉溝出血指数（SBI）そしてプロービング歯周ポケット検査（PPD）とプロービング付着喪失（PALL）加えて角質化粘膜幅（KMW）の以上で、ベースラインをはじめとして3ヶ月と6ヶ月の間隔で臨床評価した。またインプラントの安定性はベースラインと6ヶ月後にペリオテスト装置で評価した。

結果：ベースラインにおけるすべての臨床可変要因は、PPD（p<0.05）においてBグループ（2.75±1.02mm）の平均PPDがTグループ（1.97±0.65mm）と比較して有数値を示した以外には、TグループとBグループ間の統計的差異は見られず、3ヶ月の評価ではすべての臨床可変要因差異はみられなかった。6ヶ月後ではPALL（p=0.05）に関して、Tアプバメント（0.50±0.88mm）と比較しBアプバメント（0.91±0.86mm）に装着したインプラントのほうが平均PALLで有数値を示した点を除いて、両グループ間に重大な差異は検知できなかった。さらに平均ペリオテスト値（PTV）ではTアプバメントインプラント（PTV=-4.5±1.60）がBアプバメントよりp<0.05の数値で安定性を示した。

結論：ベースライン（特にBアプバメント固定段階）と6ヶ月後までの2群間の歯肉歯槽粘膜反応の差異から、テーパードアプバメントシステムがインプラント周辺軟組織安定性を促進することが明らかになった。またこのテストグループでは6ヶ月後におこなった臨床的評価でもPTV増加が観られた。

キーワード：サル、テーパードジョイントアプバメント、パットジョイントアプバメント、プラットフォームスイッチング、3ユニットブリッジ
임플란트 주변조직의 임상적 상태에 대한 지대치 설계의 영향

저자: 태이월-알리 TB (Taiyeb-Ali TB), BDS, MSc, 도 CG (Toh CG), BDS, MSc, 시아 CH (Siar CH), BDS, MSc, 세이즈 D (Seiz D), DDS, 홍 ST (Ong ST), BDS

요약:

목적: 본 연구의 목적은 3단위 Tapered (T) 지대치와 butt-join (B) 지대치로 지지되는 임플란트 치아 주변 연조직의 임상적 반응을 비교하는데 있다.

방법: Split-mouth 설계연구로, 필리핀 원순이 성체 8마리의 하악어금니를 모두 발치한 후 약 1개월 뒤에 8mm Ankylos® (엔츠플라이, 독일)임플란트를 두 번째 하약 어금니 부위에 매식하였다. 침하부위가 치유된 후 3개월째, 3단위 금속 가이치를 제작하여 식립하였다. 지대치 선택 시 임상데이터를 뭉치상태로 취합하였다. 임플란트의 임상적 검사는 기저단계가 이후 3개월, 6개월에 웨이트 플라크 지수 (Waite plaque index ;PI), 연구출혈지수 (sulcus bleeding index ;SBI), 탐침치주낭깊이 (probing pocket depth ;PPD), 부착체바소실도 (probing attachment loss ;PAL)와 각질화절막 높이 (width of keratinized mucosa ; KMW)를 조사하여 수행하였다.

결과: 초기단계의 모든 임상검사치에서 PPD (p<0.05)를 제외하고 T군과 B군 사이에서 통계적으로 유의한 차이가 발견되지 않았다. 평균 PPD는 T군 (1.97±0.65mm)과 비교 시 B군에서 (2.75±1.02mm) 더 높았다. 3개월 시점에서 얻은 검사결과는 모든 임상검사치에서 두 군간 유의한 차이가 발견되지 않았으며, 식립 후 6개월 시점에는 PAL (p=0.05)을 제외한 모든 검사수치에서 두 군간 유의한 차이가 발견되지 않았다. 6개월 시점에서 평균 PAL은 T 지대치 (0.50 ± 0.88mm)의 경우보다 B지대치가 (0.91 ± 0.86mm)로 더 높았으며, 평균 Periotest 수치 (PTV)는 T 지대치가 0.50 ± 0.88mm로 B 지대치 임플란트 (PTV= -1.5 ± 3.59)보다 더욱 안정적인 것으로 나타났다 (p<0.05).

결론: 초기단계(지대치 매식 중, 특히 B 지대치)의 식립 후 6개월시점에서 두 그룹 간 임상적반응의 차이는 Tapered 지대치 주변의 임플란트 주변 연조직 안정성이 증가되었음을 가리킨다. 또한 식립 6개월 후 임상적 동요도 평가를 위한 PTV도 역시 시험군에서 증가되었다.

키워드: 원순이, tapered-joint 지대치, butt-joint 지대치, 플랫폼 스위칭, 3-unit 가이치