Bölüm 2

DENTAL İMPLANTLARIN YÜZEY ÖZELLİKLERİ VE DEKONTAMİNASYON TEKNİKLERİ

Berceste GÜLER[1], Ahu URAZ[2]

Giriş

Dental implantların uzun dönem etkinliği genellikle alveoler kemik içerisindeki başarılı ve hızlı iyileşmeye dayanmaktadır. Dental implantların makro, mikro ve yüzey özelliklerinin kısa ve uzun dönem implant başarısı üzerine etkisi literatürde tartışılmaktadır.

Branemark ve arkadaşları tarafından ilk defa "osseointegrasyon" terimi 'titanyum implantların yumuşak dokularla ve canlı kemik doku ile enflamasyon olmaksızın yapısal olarak kaynaşması' olarak tarif edilmiştir (Branemark & ark., 1977). Araştırmacılar tarafından osseointegrasyon teriminin klinik olarak 'fonksiyonel yükleme sırasında klinik olarak asemptomatik olan implantın yüzeyi ile kemik arasında rijit bağlantının bulunması ve idamesi' olarak açıklanması önerilmiştir (Zarb & Schmitt, 1991). Kemik doku ile implant arasındaki bu yapısal ve fonksiyonel birleşim implant yüzey yapısından ve dolayısıyla osseointegrasyon derecesi ile ilişkili olarak yüzey özelliklerinden etkilenmektedir. Dental implantların niteliği implant yüzeyinin kimyasal, fiziksel, mekanik ve topografik özelliklerine bağlıdır (Grassi & ark., 2006).

İmplant Yüzey Topografisi

Dental implantlar farklı materyaller, gövde şekilleri, çap, uzunluk, platform, yüzey özellikleri ve yüzey kaplamalarından oluşmaktadır. Birçok yüzey modifikasyonu, kumla veya asitle pürüzlendirilme, pöröz-sinterleme, oksitlenme gibi çeşitli tekniklerle implantların klinik performanslarını artırmak amacıyla uygulanmaktadır. Ayrıca farklı saflık derecelerine sahip titanyumlar, titanyum alaşımları ve zirkonyum gibi çeşitli materyallerde implant yapımı için kullanılmaktadır.

İmplant yüzeyi, implant yüzeyinden madde kaybı ile ya da implant yüzeyine ilave materyaller eklenerek pürüzlendirilmektedir. Yüzey pürüzlülüğü iki farklı sembolle belirtilir. Yüzey pürüzlülüğünün iki boyutlu parametresi Ra olarak tanımlanırken üç boyutlu parametresi Sa olarak tanımlanır (Wennerberg & Albrektsson, 2009). Dental implant yüzeyleri pürüzlülük derecelerine göre dört farklı sınıfta gruplandırılmaktadır. Düz yüzeye sahip implantlarda Sa değeri 0,5 μm'den küçük iken, minimal

[1]Dr. Öğr. Üyesi, Kütahya Sağlık bilimleri Üniveristesi, Diş Hekimliği Fakültesi, berceste43@gmail.com
[2]Doç. Dr., Gazi Üniversitesi, Diş Hekimliği Fakültesi, ahuuraz@gazi.edu.tr

İmplant yüzey dekontaminasyonunun gallium-aluminum-arsenide (GaAlAs) s diod lazer ile yapıldığı bir çalışmada kemik-implant ara yüzünde, lazere bağlı olarak bir sıcaklık artışı olduğu belirtilmiştir. Diod lazer ile yapılan bir çalışmada, bir dakika lazer uygulamasından sonra peri-implant bölgede Aggregatibacter actinomycetemcomitans (A. actinomycetemcomitans), P. gingivalis ve Prevotella intermedia (P. intermedia) sayılarında bir azalma olduğu ancak bu mikroorganizmaların tam olarak elimine edilemediği belirtilmektedir (Schwarz & ark. 2009). Buna karşın dalga boyu 1064 nm olan neodymium doped yttrium aluminum garnet (Nd: YAG) lazer ile yapılan bir çalışmada enfekte implant yüzeylerine zarar vermeden etkili bir dekontaminasyon oluşturulduğu gösterilmiştir (Gonçalves & ark., 2010).

Fotodinamik Terapi

Fotodinamik terapi, fotosensitizer olarak çeşitli kimyasal çözeltilerin kullanılarak mikroorganizmalar, hücreler veya moleküllerin inaktivasyonunu sağlayan ışık olarak tanımlanmaktadır. Fotodinamik terapi, düşük aktivasyonlu dezenfeksiyon ve fotodinamik aktivasyonlu kemoterapi olmak üzere iki bölüme ayrılmaktadır ve implant yüzeylerinde lazer ışınlarına göre bakteri eliminasyonu açısından daha etkindir. Fotodinamik terapide fotosensitizer olarak, toluidin mavisi, metilen mavisi, azulen solüsyonu gibi ajanlar kullanılmaktadır (Dörtbudak & ark., 2001). Klorheksidin, fotodinamik terapi (metilen mavisi ve lazer), sadece lazer ve kontrol gruplarının karşılaştırıldığı bir çalışmada lazer olarak GaAlAs (660nm, 30mW) kullanılmış; CHX ve fotodinamik terapinin uygulandığı grupların diğer gruplara göre daha başarılı sonuçlar verdiği bildirilmiştir (Raghavendra, Koregol & Bhola, 2009). Toluidin mavisi ile beraber düşük doz lazer uygulamasının implant yüzeyindeki *A. actinomycetemcomitans*, *P. gingivalis* ve *P. intermedia* oranlarını düşürdüğü rapor edilmiştir(Marotti & ark., 2013).

Kaynakça

Albouy, J. P., Abrahamsson, I., Persson, L. G., & Berglundh, T. (2011). Implant surface characteristics influence the outcome of treatment of peri-implantitis: an experimental study in dogs. Journal of Clinical Periodontology, 38(1), 58-64.

Albrektsson, T., & Wennerberg, A. (2004). Oral implant surfaces: Part 1--review focusing on topographic and chemical properties of different surfaces and in vivo responses to them. International Journal of Prosthodontics, 17(5).

Arnhart, C., Dvorak, G., Trefil, C., Huber, C., Watzek, G., & Zechner, W. (2013). Impact of implant surface topography: a clinical study with a mean functional loading time of 85 months. Clinical oral implants research, 24(9), 1049-1054.

Berglundh, T., Persson, L., & Klinge, B. (2002). A systematic review of the incidence of biological and technical complications in implant dentistry reported in prospective longitudinal studies of at least 5 years. Journal of clinical periodontology, 29, 197-212.

Branemark, P.I., Hansson, B.O., Adell, R., Breine, U., Lindstrom, J., Hallen, O., and Ohman, A. (1977). Osseointegrated implants in the treatment of the edentulous jaw. Experience from a 10-year period. Scandinavian Journal Of Plastic And Reconstructive Surgery. 16, 1-132.

Browaeys, H., Defrancq, J., Dierens, M. C., Miremadi, R., Vandeweghe, S., Van de Velde, T., & De Bruyn, H. (2013). A retrospective analysis of early and immediately loaded osseotite implants in cross-arch rehabilitations in edentulous maxillas and mandibles up to 7 years. Clinical implant dentistry and related research, 15(3), 380-389.

Bürgers, R., Witecy, C., Hahnel, S., & Gosau, M. (2012). The effect of various topical peri-implantitis antiseptics on Staphylococcus epidermidis, Candida albicans, and Streptococcus sanguinis. Archives of oral biology, 57(7), 940-947.

Carcuac, O., Abrahamsson, I., Albouy, J. P., Linder, E., Larsson, L., & Berglundh, T. (2013). Experimental periodontitis and peri-implantitis in dogs. Clinical oral implants research, 24(4), 363-371

de Waal, Y. C., Raghoebar, G. M., Huddleston Slater, J. J., Meijer, H. J., Winkel, E. G., & van Winkelhoff, A. J. (2013). Implant decontamination during surgical peri-implantitis treatment: a randomized, double-blind, placebo-controlled trial. Journal of clinical periodontology, 40(2), 186-195.

Dierens, M., Vandeweghe, S., Kisch, J., Persson, G. R., Cosyn, J., & De Bruyn, H. (2013). Long-term follow-up of turned single implants placed in periodontally healthy patients after 16 to 22 years: microbiologic outcome. Journal of periodontology, 84(7), 880-894.

Doornewaard, R., Christiaens, V., De Bruyn, H., Jacobsson, M., Cosyn, J., Vervaeke, S., & Jacquet, W. (2017). Long-Term Effect of Surface Roughness and Patients' Factors on Crestal Bone Loss at Dental Implants. A Systematic Review and Meta-Analysis. Clinical implant dentistry and related research, 19(2), 372-399.

Dörtbudak, O., Haas, R., Bernhart, T., & Mailath-Pokorny, G. (2001). Lethal photosensitization for decontamination of implant surfaces in the treatment of peri-implantitis. Clinical oral implants research, 12(2), 104-108.

Drago, L., Del Fabbro, M., Bortolin, M., Vassena, C., De Vecchi, E., & Taschieri, S. (2014). Biofilm removal and antimicrobial activity of two different air-polishing powders: an in vitro study. Journal of Periodontology, 85(11), e363-e369.

Duarte, P. M. (2009). Short-term clinical and microbiological evaluations of peri-implant diseases before and after mechanical anti-infective therapies. Clinical Oral Implants Research, 20(1), 99-108.

Fürst, M. M., Salvi, G. E., Lang, N. P., & Persson, G. R. (2007). Bacterial colonization immediately after installation on oral titanium implants. Clinical oral implants research, 18(4), 501-508.

Gonçalves, F., Zanetti, A. L., Zanetti, R. V., Martelli, F. S., Avila-Campos, M. J., Tomazinho, L. F., & Granjeiro, J. M. (2010). Effectiveness of 980-mm diode and 1064-nm extra-long-pulse neodymium-doped yttrium aluminum garnet lasers in implant disinfection. Photomedicine and laser surgery, 28(2), 273-280.

Gosau, M., Hahnel, S., Schwarz, F., Gerlach, T., Reichert, T. E., & Bürgers, R. (2010). Effect of six different peri-implantitis disinfection methods on in vivo human oral biofilm. Clinical oral implants research, 21(8), 866-872.

Grassi S, Piattelli A, de Figueiredo LC, Feres M, de Melo L, Iezzi G, Alba RC Jr, Shibli JA. (2006). Histologic evaluation of early human bone response to different implant surfaces. Journal of periodontology, 77(10), 1736-1743.

Guimarães, L. F., da Silva Fidalgo, T. K., Menezes, G. C., Primo, L. G., & e Silva-Filho, F. C. (2010). Effects of citric acid on cultured human osteoblastic cells. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology, 110(5), 665-669.

Gustumhaugen, E., Lönn-Stensrud, J., Scheie, A. A., Lyngstadaas, S. P., Ekfeldt, A., & Taxt-Lamolle, S. (2014). Effect of chemical and mechanical debridement techniques on bacterial re-growth on rough titanium surfaces: an in vitro study. Clinical oral implants research, 25(6), 707-713.

Hägi, T. T., Hofmänner, P., Eick, S., Donnet, M., Salvi, G. E., Sculean, A., & Ramseier, C. A. (2015). The effects of erythritol air-polishing powder on microbiologic and clinical outcomes during supportive periodontal therapy: Six-month results of a randomized controlled clinical trial. Quintessence international, 46(1),31-41.

Heitz-Mayfield, L. J., Salvi, G. E., Botticelli, D., Mombelli, A., Faddy, M., Lang, N. P., & Implant Complication Research Group (ICRG). (2011). Anti-infective treatment of peri-implant mucositis: a randomised controlled clinical trial. Clinical oral implants research, 22(3), 237-241.

Jepsen S, Berglundh T, Genco R, Aass M, Demirel K, Derks J, Figuero E, Giovannoli E, Goldstein M, Lambert F, Ortiz-Vigon A, Polyzois I, Salvi G, Schwarz F, Serino G, Thomasi C, Zitzmann N. (2015). Primary prevention of peri-implantitis: Managing peri-implant mucositis. Journal of clinical periodontology, 42, S152-S157.

Jimbo, R., & Albrektsson, T. (2015). Long-term clinical success of minimally and moderately rough oral implants: a review of 71 studies with 5 years or more of follow-up. Implant dentistry, 24(1), 62-69.

John, G., Becker, J., & Schwarz, F. (2015). Modified implant surface with slower and less initial biofilm formation. Clinical implant dentistry and related research, 17(3), 461-468.

Jungner, M., Lundqvist, P., & Lundgren, S. (2014). A retrospective comparison of oxidized and turned implants with respect to implant survival, marginal bone level and peri-implant soft tissue conditions after at least 5 years in function. Clinical implant dentistry and related research, 16(2), 230-237.

Klinge B, Flemming T, Cosyn J, De Bruyn H, Eisner BM, Hultin M, Isidor F, Lang NP, Lund B, Meyle J, Mombelli A, Navarro JM, Pjetursson B, Renvert S, Schliephake H (2015). The patient undergoing implant therapy. Summary and consensus statements. The 4th EAO Consensus Conference 2015. Clinical oral implants research, 26, 64-67

Kreisler, M., Kohnen, W., Christoffers, A. B., Götz, H., Jansen, B., Duschner, H., & d'Hoedt, B. (2005). In vitro evaluation of the biocompatibility of contaminated implant surfaces treated with an Er: YAG laser and an air powder system. Clinical oral implants research, 16(1), 36-43.

Lang, N. P., & Jepsen, S. (2009). Implant surfaces and design (Working Group 4). Clinical Oral Implants Research, 20, 228-231.

Lindhe, J., Meyle, J., & Group D of the European Workshop on Periodontology. (2008). Peri-implant diseases: consensus report of the sixth European workshop on periodontology. Journal of clinical periodontology, 35, 282-285.

Mann, M., Parmar, D., Walmsley, A. D., & Lea, S. C. (2012). Effect of plastic-covered ultrasonic scalers on titanium implant surfaces. Clinical oral implants research, 23(1), 76-82.

Marotti, J., Tortamano, P., Cai, S., Ribeiro, M. S., Franco, J. E. M., & de Campos, T. T. (2013). Decontamination of dental implant surfaces by means of photodynamic therapy. Lasers in medical science, 28(1), 303-309.

Mengel, R., Buns, C. E., Mengel, C., & Flores-de-Jacoby, L. (1998). An in vitro study of the treatment of implant surfaces with different instruments. International Journal of Oral & Maxillofacial Implants, 13(1).

Mouhyi, J., Dohan Ehrenfest, D. M., & Albrektsson, T. (2012). The peri-implantitis: implant surfaces, microstructure, and physicochemical aspects. Clinical implant dentistry and related research, 14(2), 170-183.

Mozzati, M., Gallesio, G., & Del Fabbro, M. (2015). Long-term (9–12 years) outcomes of titanium implants with an oxidized surface: a retrospective investigation on 209 implants. Journal of Oral Implantology, 41(4), 437-443.

Nemer, L. V., Cardoso, E. S., Machado, S. J., da Silva Pereira, C., & Vidigal, J. G. (2012). Effectiveness of implant surface decontamination using a high-pressure sodium bicarbonate protocol: an in vitro study. Implant dentistry, 21(5), 390-393.

Östman, P. O., Hellman, M., & Sennerby, L. (2012). Ten years later. Results from a prospective single-centre clinical study on 121 oxidized (TiUnite™) Brånemark implants in 46 patients. Clinical implant dentistry and related research, 14(6), 852-860.

Park, J. B. (2012). Treatment of peri-implantitis with deproteinised bovine bone and tetracycline: a case report. Gerodontology, 29(2), 145-149

Park, S. Y., Kim, K. H., Shin, S. Y., Koo, K. T., Lee, Y. M., Chung, C. P., & Seol, Y. J. (2015). Decontamination methods using a dental water jet and dental floss for microthreaded implant fixtures in regenerative periimplantitis treatment. Implant dentistry, 24(3), 307-316.

Persson, L. G., Araújo, M. G., Berglundh, T., Gröndahl, K., & Lindhe, J. (1999). Resolution of peri-implantitis following treatment. An experimental study in the dog. Clinical Oral Implants Research, 10(3), 195-203.

Persson, L. G., Mouhyi, J., Berglundh, T., Sennerby, L., & Lindhe, J. (2004). Carbon dioxide laser and hydrogen peroxide conditioning in the treatment of periimplantitis: an experimental study in the dog. Clinical implant dentistry and related research, 6(4), 230-238.

Polizzi, G., Gualini, F., & Friberg, B. (2013). A two-center retrospective analysis of long-term clinical and radiologic data of TiUnite and turned implants placed in the same mouth. International Journal of Prosthodontics, 26(4), 350-358.

Raghavendra, M., Koregol, A., & Bhola, S. (2009). Photodynamic therapy: a targeted therapy in periodontics. Australian dental journal, 54, S102-S109.

Renvert, S., Lindahl, C., & Rutger Persson, G. (2012). The incidence of peri-implantitis for two different implant systems over a period of thirteen years. Journal of clinical periodontology, 39(12), 1191-1197.

Renvert, S., Samuelsson, E., Lindahl, C., & Persson, G. R. (2009). Mechanical non-surgical treatment of peri-implantitis: a double-blind randomized longitudinal clinical study. I: clinical results. Journal of clinical periodontology, 36(7), 604-609

Rocci, A., Rocci, M., Rocci, C., Scoccia, A., Gargari, M., Martignoni, M., ... & Sennerby, L. (2013). Immediate loading of Brånemark system TiUnite and machined-surface implants in the posterior mandible, part II: a randomized open-ended 9-year follow-up clinical trial. International Journal of Oral & Maxillofacial Implants, 28(3), 891-895.

Romeo, E., Lops, D., Chiapasco, M., Ghisolfi, M., & Vogel, G. (2007). Therapy of peri-implantitis with resective surgery. A 3-year clinical trial on rough screw-shaped oral implants. Part II: radiographic outcome. Clinical Oral Implants Research, 18(2), 179-187.

Schwarz F, Aoki A, Sculean A, Becker J. The impact of laser application on periodontal and peri-implant wound healing. Periodontol 2000. 2009;51:79-108.

Schwarz, F., Maraki, D., Yalcinkaya, S., Bieling, K., Böcking, A., & Becker, J. (2005). Cytologic and DNA-cytometric follow-up of oral leukoplakia after CO2-and Er: YAG-laser assisted ablation: A pilot study. Lasers in Surgery and Medicine: The Official Journal of the American Society for Laser Medicine and Surgery, 37(1), 29-36.

Schwarz, F., Sahm, N., Iglhaut, G., & Becker, J. (2011). Impact of the method of surface debridement and decontamination on the clinical outcome following combined surgical therapy of peri-implantitis: a randomized controlled clinical study. Journal of clinical periodontology, 38(3), 276-284.

Schwarz, F., Sculean, A., Bieling, K., Ferrari, D., Rothamel, D., & Becker, J. (2008). Two-year clinical results following treatment of peri-implantitis lesions using a nanocrystalline hydroxyapatite or a natural bone mineral in combination with a collagen membrane. Journal of Clinical Periodontology, 35(1), 80-87.

Sharon, E., Shapira, L., Wilensky, A., Abu-hatoum, R., & Smidt, A. (2013). Efficiency and thermal changes during implantoplasty in relation to bur type. Clinical implant dentistry and related research, 15(2), 292-296.

Takasaki, A. A., Aoki, A., Mizutani, K., Kikuchi, S., Oda, S., & Ishikawa, I. (2007). Er: YAG laser therapy for peri-implant infection: a histological study. Lasers in medical science, 22(3), 143-157.

Teughels, W., Van Assche, N., Sliepen, I., & Quirynen, M. (2006). Effect of material characteristics and/or surface topography on biofilm development. Clinical oral implants research, 17(S2), 68-81.

Van Assche, N., Pittayapat, P., Jacobs, R., Pauwels, M., Teughels, W., & Quirynen, M. (2011). Microbiological outcome of two screw-shaped titanium implant systems placed following a split-mouth randomised protocol, at the 12th year of follow-up after loading. European journal of oral implantology, 4(2),103-116.

Vandeweghe, S., Ferreira, D., Vermeersch, L., Mariën, M., & De Bruyn, H. (2016). Long-term retrospective follow-up of turned and moderately rough implants in the edentulous jaw. Clinical oral implants research, 27(4), 421-426.

Walsh, L. J. (2000). Safety issues relating to the use of hydrogen peroxide in dentistry. Australian dental journal, 45(4), 257-269.

Wennerberg, A., & Albrektsson, T. (2009). Effects of titanium surface topography on bone integration: a systematic review. Clinical oral implants research, 20, 172-184.

Wohlfahrt, J. C., & Lyngstadaas, S. P. (2012). Mechanical debridement of a peri-implant osseous defect with a novel titanium brush and reconstruction with porous titanium granules: a case report with reentry surgery. Clinical Advances in Periodontics, 2(3), 136-140.

Wohlfahrt, J. C., Lyngstadaas, S. P., Rønold, H. J., Saxegaard, E., Ellingsen, J. E., Karlsson, S., & Aass, A. M. (2012). Porous titanium granules in the surgical treatment of peri-implant osseous defects: a randomized clinical trial. International Journal of Oral & Maxillofacial Implants, 27(2).

Zarb, G. A., & Schmitt, A. (1991). Osseointegration and the edentulous predicament. The 10-year-old Toronto study. British dental journal, 170(12), 439.

Zitzmann, N. U., & Berglundh, T. (2008). Definition and prevalence of peri-implant diseases. Journal of clinical periodontology, 35, 286-291.