

种植体颈部设计对种植体周围硬组织的影响

管叶^{1,2}, 周怡^{1,2}, 何福明^{1,2}

¹浙江大学医学院附属口腔医院, 浙江 杭州

²浙江省口腔生物医学研究重点实验室, 浙江 杭州

Email: 21818734@zju.edu.cn, hfm@zju.edu.cn

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摘要

种植体周围硬组织的健康和稳定对种植修复的成功有着非常重要的意义, 而种植体颈部的设计对其有着不可忽视的影响。本文的目的是通过文献回顾来评估不同类型的种植体颈部特征对种植体周围软硬组织的影响, 以期为今后临床选择不同颈部设计的种植体提供一定的参考。

关键词

牙种植体, 种植体颈部设计, 边缘骨吸收

The Influence of Implant Neck Design on Hard and Soft Tissue around Implant

Ye Guan^{1,2}, Yi Zhou^{1,2}, Fuming He^{1,2}

¹The Affiliated Stomatology Hospital, Zhejiang University School of Medicine, Hangzhou Zhejiang

²Key Laboratory of Oral Biomedical Research of Zhejiang Province, Hangzhou Zhejiang

Email: 21818734@zju.edu.cn, hfm@zju.edu.cn

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Abstract

The health and stability of the hard tissue around the implant is important for the success of the implant restoration, and effects of the design of the implant neck on peri-implant tissue cannot be ignored. The purpose of this article is to evaluate impacts of different implant neck characteristics on the hard tissue around the implant through a literature review, in order to provide a certain reference for the future clinical selection of implants with different neck designs.

Keywords

Dental Implant, Implant Neck Design, Marginal Bone Loss

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1. 引言

近年来, 种植修复已经成为一种广泛接受的治疗方法, 以恢复缺失牙的美观和功能。临床研究发现, 种植修复 10 年以上的平均存活率为 94.6%, 平均成功率为 89.7% [1]。种植体的长期临床成功主要取决于种植体周围骨量的保存[2], 其成功的标准为: 种植后第一年的边缘骨吸收小于 2.0 毫米, 此后每年小于 0.2 毫米[3]。尽可能长期保持最初的种植体周围骨水平对长期的成功和取得良好的美学效果至关重要[4] [5]。

牙槽骨改建是一个复杂的过程, 许多因素会造成种植体周围的边缘骨吸收(Marginal Bone Loss, MBL)。这些因素主要包括牙槽骨密度和骨量[6] [7]; 牙龈生物型[8]; 邻牙情况[9]; 与邻牙间的距离[10] [11]; 生物学宽度的保持[12]和平台转移的使用(Platform-Switching, PS) [13]; 不同品牌的种植体宏观、微观的设计和尺寸[14]; 骨增量手术, 包括手术方式和所用的植骨材料[15] [16]; 软组织的管理[17] [18]和植入的时间点(即刻、早期和延期种植, 修复方式即刻负载和延期负载) [19] [20] [21]; 种植体植入的深度[22] [23] [24]以及患者的依从性、口腔卫生、是否吸烟和全身状况等[25]。

种植体颈部(implant neck/cervix)为种植体的冠方部分, 最冠方称为种植体的平台(platform)。由于种植体的边缘骨吸收发生于颈部周围[26], 并且从生物力学的角度来看, 颈部牙槽嵴承担了牙槽骨中最大的应力[27] [28], 所以种植体的颈部被认为是种植体设计最重要的特征之一。

种植体颈部的表面处理和形状直径可以与体部不同, 也可以与体部完全相同(例如颈部为光滑表面, 体部为粗糙表面; 种植体颈部相对体部有缩窄设计等)。目前市场上已出现了大量不同的颈部设计, 例如使用光滑颈部表面或粗糙表面以及通过激光蚀刻等方式形成颈部微螺纹表面等。迄今为止, 这些不同设计对种植体周围骨组织的影响尚未达成共识。本系统综述的目的是评估不同种植体颈部特征对种植体存活率、边缘骨水平变化以及种植体周围硬组织健康的影响, 为临床决策提供一定的参考。

2. 种植体颈部设计分类

2.1. 一段式种植体与两段式种植体

一段式种植体(one-stage implant)又称为一体式种植体(one-piece implant), 其穿黏膜颈部与位于骨内的体部合为一体, 颈部位于软组织之内, 平台可以位于牙槽嵴表面的软组织之内或软组织之外, 因此也可称之为软组织水平种植体(tissue level implant)或非潜入式种植体(nonsubmerged implant)。

两段式种植体(two-stage implant)又称为分体式种植体(two-piece implant), 其本身没有穿黏膜颈部, 穿黏膜部分为与种植体分离的另一部件, 种植体平台位于牙槽嵴之内, 因此也称之为骨水平种植体(bone level implant)或潜入式种植体(submerged implant) [29]。

2.2. 种植体颈部宏观设计

种植体的颈部的宏观设计主要指颈部宏观形状, 分为直颈、窄颈或宽颈, 分别指种植体颈部最冠方

处的直径等于、小于或大于种植体体部。近年来也出现了一些较为新颖的种植体颈部形状设计，如三角形颈部或扇形颈部等(见图 1)。

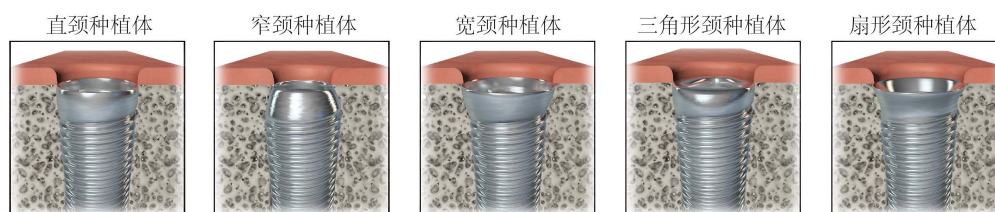


Figure 1. Macroscopic classification of implant neck design
图 1. 种植体颈部宏观设计分类示意图

2.3. 种植体颈部表面微观设计

种植体颈部微观设计主要指的是颈部光滑与粗糙表面，光滑颈通常指机械加工形成的光滑颈部设计，粗糙颈则指的是通过酸蚀激光等表面处理形成粗糙的颈部表面，包括微螺纹表面。一些研究认为，粗糙的颈部表面可以实现更快的骨结合、增加牙槽骨与种植体之间的接触面积并减少骨吸收，提高存活率[30] [31] [32]。另一些研究认为，光滑的颈部表面易于清洁，有助于种周疾病的控制[33] [34] [35] [36]。

3. 种植体颈部不同设计对骨吸收的影响

3.1. 一段式和两段式植体

大部分研究的结论认为，两段式植体的边缘骨吸收(Marginal Bone Loss, MBL)较低，而两类植体的失败率无明显差异。Arrejaie 等人进行的一项 Meta 分析[37]共纳入了 11 项研究，结果显示两段式植体的 MBL 与一段式植体相比显著较低，而失败率和种植体周围炎发生率均无统计学差异。Troiano G 等人进行的一项 meta 分析[38]共纳入了 11 项研究，结果同样表明两段式植体的 MBL 较低，尽管两组差异非常小(0.13 mm)。需要注意的是，当使用一段式植体，采用非潜入式愈合时，早期种植失败率较高(2%)。

然而也有一些研究认为一段式植体的 MBL 较低。Moustafa Ali 等人的一项 meta 分析[39]共纳入了 8 项研究，结果显示一段式种植体周围的 MBL 明显更低；且两类植体在失败率方面没有差异。Cosola 等人进行的一项系统性回顾纳入了 45 项研究，其中 3 项报道了两段式种植体 MBL 的较少($p < 0.05$) [40] [41] [42]，仅有 1 项报道了一段式种植体的 MBL 较少($p < 0.05$) [43]。在其余的 41 项研究中，两类植体间 MBL 的差异无统计学意义[44]。

3.2. 种植体颈部宏观形状

目前关于窄颈和宽颈的研究数量较为有限，结果也各不相同。Calvo-Guirado 等人[45]在 6 只比格犬的上颌骨中植入了窄颈和宽颈两种不同颈部设计的超短种植体，共 36 颗，12 周后发现，窄颈组骨吸收较少。然而，Montemezzi 等人[46]进行的一项为期两年的前瞻性研究中，对 97 名患者植入了 122 颗种植体，宽颈组和窄颈组分别为 59 颗和 63 颗，两年随访发现，宽颈组边缘骨吸收较少。

关于种植体新型颈部设计，目前主要出现了三角形、扇形和斜坡式设计。Falco 等人[47]将 120 颗不同颈部设计的种植体分别植入牛羊骨中，发现在中等密度的骨中，窄颈比直颈种植体稳定性更差。一项为期两年的前瞻性研究在患者的上颌后牙区随机植入了新型三角颈或传统圆颈种植体，发现 45 天内的初期稳定性圆颈高于三角颈，但是经过 45 天的骨改建后，两者间的差异变得非常小[48]，这表明种植体颈部形状对种植体二级稳定性的作用并不明显。

Tallarico 等人的一项系统评价[49]评估了具有两段式颈部设计的种植体与一段式种植体以及在美学区域具有扇形或斜坡式肩台的种植体,证实了不同的种植体颈部设计(扇形、斜坡和一段式)与两段式设计相比,没有任何益处。

虽然关于种植体颈部的形状差异对周围硬组织稳定性的影响仍不明确,但是对于已发生骨吸收的薄牙槽嵴来说,选择窄颈种植体可能更为合适。因为菲薄的骨板缺乏血管或骨内膜,随着时间的流逝,容易发生缺血性骨坏死。在相同的钻孔流程下,较宽的颈部可能会造成皮质骨压缩,从而增加骨开裂和微裂纹发生的风险。而严重的裂纹则可能导致种植体部分表面无骨结合,增加种植失败的风险。

3.3. 种植体粗糙颈和光滑颈

有许多研究认为,粗糙的颈部表面可以实现更快的骨结合,增加牙槽骨与种植体之间的接触面积,并减少骨吸收。全球口腔重建基金会(ORF)2019年[30]发表的一项调查报告称,在单冠和局部固定修复体中,粗糙颈种植体的边缘骨吸收显著低于光滑颈(MD 0.44 mm [0.04, 0.83], $p = 0.03$)。Mendoca 等[31]对 138 例患者的 242 颗种植体进行了为期 6 年的回顾性研究,其中 126 颗具有 0.8 mm 的光滑颈部,116 颗具有 0.3 mm 的粗糙颈部。两组种植体的成功率相似,分别为 95.0%和 95.9%。然而在下颌骨中,与光滑颈组(1.58 ± 0.73 mm)相比,粗糙颈组(1.20 ± 0.52 mm)的边缘骨吸收较少。Patil 等人[32]的一项前瞻性研究中,在 150 例患者后牙区分别植入具有 2mm 光滑颈部的种植体和具有微螺纹粗糙颈部的种植体,共 100 颗,均为骨水平种植。植入 1 年后,粗糙颈组种植体周围的平均骨吸收(3.23 mm)明显低于光滑颈组(3.75 mm)。

另一些研究则认为光滑颈有助于减少边缘骨吸收,并能延缓种植体周围炎的进展。Sanchez-Siles 等人[33]进行了一项为期 10 年的回顾性研究,对 400 例患者的 1244 颗种植体进行了随访,其中 515 颗具有 2.5 mm 的光滑颈部,729 颗无光滑颈部。光滑颈组采用软组织水平种植,无光滑颈组采用骨水平种植。结果显示,与非光滑颈组(2.41 ± 1.35 mm)相比,光滑颈组种植体的边缘骨吸收(1.18 ± 1.39 mm)明显较少($p < 0.001$)。同样的,Axiotis 等人[34]进行的一项为期 6 年的回顾性研究也表明了具有光滑颈部的一段式种植体拥有较高的成功率和良好的长期边缘骨保存效果。Raes 等人[35]在有严重牙周炎病史的患者中植入了光滑与粗糙表面的两组种植体,均为骨水平种植。随访 5 年后,发现光滑表面种植体的边缘骨吸收更少,而粗糙表面种植体的牙周疾病发生率更高。Quirynen 等[36]的研究显示,光滑表面暴露于口内时,其上积聚的龈下菌斑量较粗糙表面减少 25 倍,并且更易于清洁。综上所述,对于牙周炎患者来说,光滑颈种植体可能是更好的选择。

还有一些临床研究发现,具有相同宏观几何形状、连接方式和相似的临床情况时,光滑颈与粗糙颈的在边缘骨保存方面没有显著差异。Menini 等人[50]对 8 位患者分别植入了 10 颗光滑颈和 10 颗粗糙颈种植体,6 年随访后发现,除了第一年粗糙颈组边缘骨吸收明显低于光滑颈组,随后的五年中两组的骨吸收没有明显差异。Nicu 等人[51]对 9 名有牙周病史的无牙颌患者和 5 名中重度牙周炎的牙列缺损患者随机植入光滑颈与粗糙颈种植体,3 年负载后,光滑颈与粗糙颈种植体表现出了相似的临床效果。Rocci 等人[52]对 44 位患者植入了 66 颗粗糙颈种植体和 55 颗光滑颈种植体,均为即刻负载,进行了九年的随访。第一年时粗糙颈组边缘骨吸收为 0.9 mm,光滑颈组为 1.0 mm;第三年分别为 0.4 和 0.5 mm;第九年时骨吸收可忽略不计。Hartog 等人[53]对 93 位上颌前牙缺失的患者随机植入种植体,共植入 31 颗具有 1.5 mm 的光滑颈部的种植体(光滑颈组),31 颗粗糙颈部的种植体(粗糙颈组)和 31 颗扇形粗糙颈部(扇形颈组)的种植体。均为骨水平种植,植入时种植体肩台位于未来临床牙冠的根方 3 mm 处。5 年随访显示,扇形组有明显更多的边缘骨吸收(2.28 ± 0.97 mm),而光滑颈组(1.26 ± 0.90 mm)与粗糙颈组(1.20 ± 1.1 mm)差异不大。

4. 小结

综上, 目前对于种植体颈部设计的研究仍存在争议, 基于本文中所涉及的文献, 我们可以得出以下结论: 第一, 种植体颈部的形状以窄颈为佳, 其在植入时对皮质骨的压力较小, 可以减小骨开裂和产生微裂纹的风险; 第二, 迄今为止, 粗糙颈和机械颈对边缘骨水平的保存方面尚无统一论。但是在可能发生种植体周围炎风险较高的情况下, 机械加工的光滑颈具有优势, 因为它更易于清洁, 并且可能减缓种植周疾病的发展。

5. 研究展望

口腔种植治疗一直在朝着改善治疗和提高可预测性的方向发展, 尤其是在维持牙槽骨水平方面。相信随着种植体颈部设计研究的不断进展, 未来的种植治疗将进一步减少种植体颈部周围边缘骨吸收的发生。

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