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· 专家论坛 ·

软组织增量在前牙区种植唇侧轮廓美学中的应用

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【摘要】 天然牙拔除后,其唇侧轮廓常因生理性骨改建而出现塌陷。在前牙区种植位点,为了获得理想的粉色美学效果,常使用骨增量或软组织增量来维持或重建唇侧组织轮廓。在前牙区选择软组织增量恢复美学效果时,需严格把控适应证,只有对于软组织健康且无骨缺损或仅有水平向轻度骨缺损的患者,才可以考虑直接通过软组织增量维持或重建唇侧组织轮廓。在即刻、早期和延期种植中,软组织增量的选择时机各不相同。即刻种植时,唇侧骨板完整,常推荐同期软组织移植以更好地维持唇侧组织轮廓;而在早期或延期种植时,患者已经存在较大范围骨缺损时,同期软硬组织增量风险较高,常选择在一期手术时行骨增量手术,二期手术时行软组织增量手术。软组织增量目前主要为邻近自体软组织移植,如游离龈移植、上皮下结缔组织移植或带蒂腭侧瓣移植等,但手术常伴有第二术区,会增加患者术后反应以及手术操作时长,因此寻找长期稳定的生物替代材料是发展的必然趋势。本文将对使用软组织增量进行唇侧轮廓维持和重建的适应证、时机以及不同方法作述评。

【关键词】 前牙美学区; 牙种植; 种植体周软组织; 软组织增量; 游离龈移植; 上皮下结缔组织移植; 带蒂腭侧瓣移植; 生物材料

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【Abstract】 After tooth extraction, labial contour collapses due to inevitable physiologic bone remodeling. To achieve optimal outcomes for pink esthetic treatment at anterior implant sites, bone or soft tissue augmentation has been advocated to maintain or reconstruct the labial tissue contour. When choosing soft tissue augmentation for esthetic restoration, it is necessary to strictly grasp the indications for surgery. Soft tissue augmentation to maintain or reconstruct the labial tissue contour could be considered in patients with healthy soft tissue and no bone defects or only mild horizontal bone defects. In immediate, early and late implant placement, the timing of soft tissue augmentation may vary. In immediate implantation, the labial bone plate is intact, so it is highly recommended to simultaneously manage soft tissue during implant placement. However, patients may have large bone defects with early or late implant placement. The risk of augmenting bone and soft tissue simultaneously is likely too high, and bone augmentation surgery is often performed at the first stage while soft tissue augmentation surgery is performed at the second stage. Therefore, soft tissue surgery is often carried out simultaneously with abutment connection. Currently, soft tissue augmentation is achieved mostly with adjacent autologous soft tissue grafts, such as free gingival grafts, subepithelial connective tissue grafts or pedicle palatal flaps, which are often accompanied by a second surgical area. The replacement of autogenous soft tissue grafting with

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new biological materials will become an inevitable trend. In this article, we analyze and summarize the indications, timing and different methods of soft tissue augmentation to maintain and reconstruct the labial contour.

【Key words】 anterior teeth esthetic zone; dental implants; peri-implant soft tissue; soft tissue augmentation; free gingival graft; subepithelial connective tissue graft; pedicle palatal flap; biomaterial

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达到理想的美学效果一直是前牙区种植修复的目标。Fürhauser等^[1]在2005年首先提出粉色美学评分(pink esthetic score, PES)来评价种植体周软组织的美学效果,包括近远中牙龈乳头充盈度、唇侧龈缘水平、唇侧穿龈形态、牙槽嵴缺损、软组织颜色和质地。随后Belser等^[2]对PES评分指标作了改良,将“牙槽嵴缺损”进一步理解为“唇侧骨弓轮廓(root convexity)”,即在种植体唇侧软组织形态是否呈现与天然牙类似的凸状“根型”,这让种植修复具有更生动的美学表现。PES被广泛应用于临床研究中的软组织美学评估,它对前牙美学区种植提出了更高的要求和挑战,其中唇侧骨弓轮廓在各项指标中最难达到^[3]。

天然牙的唇侧轮廓主要由牙龈、牙槽骨、牙周膜和牙根支撑,拔除天然牙过程中,连接牙骨质与牙槽骨的牙周膜被破坏,而牙周膜是维持牙槽骨动态骨平衡血供的重要来源之一,在缺少牙周膜血供后,破骨细胞活跃,牙周膜纤维连接的束状骨在拔牙后8周内基本完全吸收^[4-5]。在前牙美学区,90%患者的唇侧骨板厚度 $\leq 1\text{ mm}$ ^[6],50%患者骨板厚度 $\leq 0.5\text{ mm}$ ^[7],而束状骨厚约 $0.2\sim 0.4\text{ mm}$ ^[8],这意味着上前牙的唇侧骨板大部分由束状骨组成。一旦拔除天然牙,牙槽窝内部的束状骨和外部的颊舌骨壁均会发生吸收,在第一年骨宽度就平均减少50%^[9],唇侧骨板高度则平均降低5.2 mm,约48.3%,如果唇侧骨板厚度 $\leq 1\text{ mm}$,拔牙后8周唇侧骨板几乎已经完全吸收,软组织高度则减少约1.6 mm^[10-11]。

随着拔牙后软硬组织的生理性变化,唇侧轮廓塌陷是可预见的。如何重建唇侧组织轮廓以达到理想的美学效果,成为前牙区种植无法避开的难题。近年来,软组织增量成为维持和重建种植位点唇侧轮廓的常用手段之一^[12]。本文将对软组织增量在美学区种植维持和重建唇侧轮廓的应用

进行分析和总结。

1 软组织增量适应证

薄龈生物型患者在即刻种植后出现龈缘退缩的风险较高^[13],也可能存在难以完全遮挡基台颜色的风险,所以唇侧至少需要2 mm以上的黏膜厚度^[14]。足够厚度的软组织除了避免龈缘退缩,还能减少边缘骨吸收,维持唇侧组织的稳定和种植体周健康^[14-15],软组织增量能够有效改善患者的牙龈生物型^[16]。

即刻种植并不能完全抵抗唇侧轮廓塌陷,翻瓣手术更是会损伤骨膜血管,导致急性炎症反应,加速暴露的骨面吸收^[17]。大量研究表明,在非翻瓣即刻种植手术同期软组织增量,增厚了牙龈厚度,虽很难完全补偿唇侧骨板的吸收,但显著减少了唇侧组织塌陷,更好地维持唇侧轮廓的丰满度^[18-22]。

Seibert等^[23]将牙槽嵴缺损分为3型:I型为水平型,即仅存在唇(颊)舌向骨缺损;II型为垂直型,仅存在垂直向骨缺损;III型则为联合型。在骨缺损患者中,基于外科和生物学考量,骨增量常是必不可少的^[24],但有研究者尝试对Seibert I型骨缺损患者通过软组织增量来重建唇侧组织形态^[25-27]。他们发现骨增量或软组织增量均可以恢复患者唇侧轮廓,PES评分没有显著性差异,其中58%骨增量患者最终仍出现了轮廓轻度塌陷,而在软组织增量患者中这一比例为38%。同时,考虑到骨增量需翻瓣至骨膜,以及常附加垂直切口,不仅存在美学区瘢痕的风险,患者术后疼痛不适也更为强烈。因此软组织增量可能能够降低甚至替代轻度水平型骨缺损中骨增量的需求,达到理想的美学效果,但是软组织增量是否较硬组织增量效果更好或者有其他的积极作用,目前仍待更多的研究。

综合以上观点及笔者临床经验,笔者认为软组织增量在恢复美学区唇侧轮廓是可行的,但需严格把控适应证,在术者经验丰富以及患者满足以下条件时,可考虑行软组织增量达到前牙区更理想美学效果:①位点为薄龈生物型且软组织健康时,行软组织增量以改善牙龈生物型;②即刻种植位点行软组织增量以维持唇侧轮廓;③位点仅有水平向轻度牙槽嵴萎缩且软组织健康时,行软组织增量以重建唇侧轮廓。

2 软组织增量时机选择

Thoma等^[28]将软组织管理分为以下5个时间点:①种植前;②种植同期;③种植愈合期(种植体植入后、二期手术前的时期);④二期手术同期;⑤修复负载后。

尽管Thoma等^[12]在2021年第六届欧洲骨结合学会(EAO)共识会议上提出并没有某个时间点是绝对优于其它时间,但是其也提出在前4个阶段进行软组织的相关干预,更有利于维持种植体周组织的稳定,在负载后再进行软组织增量,最终效果的可预期性相对较差^[28],这与Chackartchi等^[29]的观点也是一致的。

即刻种植适应证严苛,要求患者唇侧骨板完整,为获得理想的美学效果,常采用非翻瓣手术,此时患者唇侧骨板及软组织均无损伤,满足软组织移植的需求,尽管在即刻种植同期软组织增量不能完全弥补拔牙后唇侧骨板改建,Thoma等^[28]也建议通过该方法以获得更理想的美学表现。但在早期或延期种植中,可能同时伴随软硬组织的缺

损,若种植位点同期软硬组织增量,大量骨移植材料不易于为软组织移植物提供稳定的固定和足够的血供,同时植骨材料也缺乏周围软组织的血供和稳定封闭环境,容易出现成骨不良^[30],综合考虑,建议在二期手术时处理软组织,不仅减少患者手术次数,还可以避免软硬组织同期增量可能出现的成骨不足。

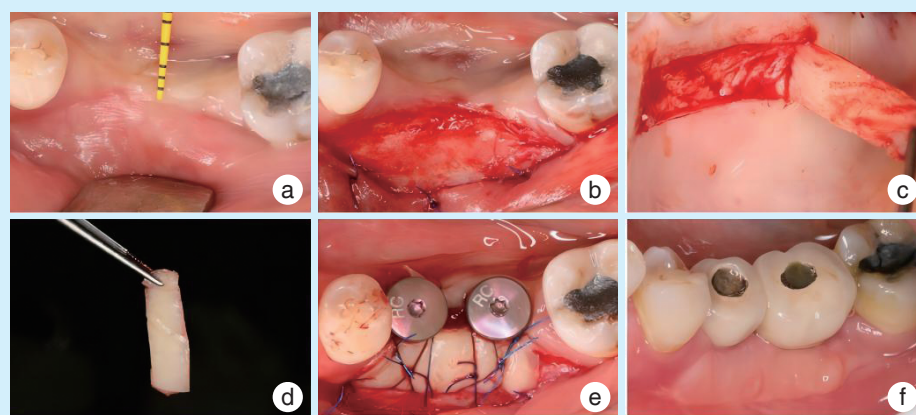
3 唇侧轮廓维持与重建的方法

3.1 游离龈移植

从腭侧获取的带有表层上皮的软组织移植被称为游离龈移植(free gingival graft, FGG), FGG常与根向复位瓣(apically repositioned flap, ARF)联合使用来加深患者前庭沟深度、角化龈宽度以及厚度^[31]。对比单纯ARF组或ARF+生物材料胶原基质(collagen matrix, CM)组, APF+FGG组获得的角化黏膜量最多^[32-33],自体软组织移植物在增加角化龈宽度和厚度的可预期性最佳^[15]。但FGG组较生物材料组手术操作时间长,术后疼痛更剧烈,更重要的是新获得组织的颜色形态与受区周围组织不协调^[32],因此虽然FGG能够长期稳定增加唇侧软组织丰满度,却仍然极少用于美学区(图1)。

3.2 上皮下结缔组织移植

牙周手术最初目的只是为了恢复牙周组织实用性,但现在新理念是获得理想的美学效果。为避免上皮软组织移植后颜色形态与受区不匹配, Zuhr等^[34]提出了上皮下结缔组织移植(subepithelial connective tissue graft, SCTG),它可以直接从上腭或者上颌结节处,使用单/双切口获得,也可以先制取



a: the width of the keratinized gingiva; b: apically repositioned flap preparation and suturing to the periosteum; c: preparation of free gingival graft at the donor site; d: free gingival graft; e: free gingival graft sutured to the periosteum; f: 6-month healing

Figure 1 Apically positioned flap with free gingival graft for increased keratinized gingiva

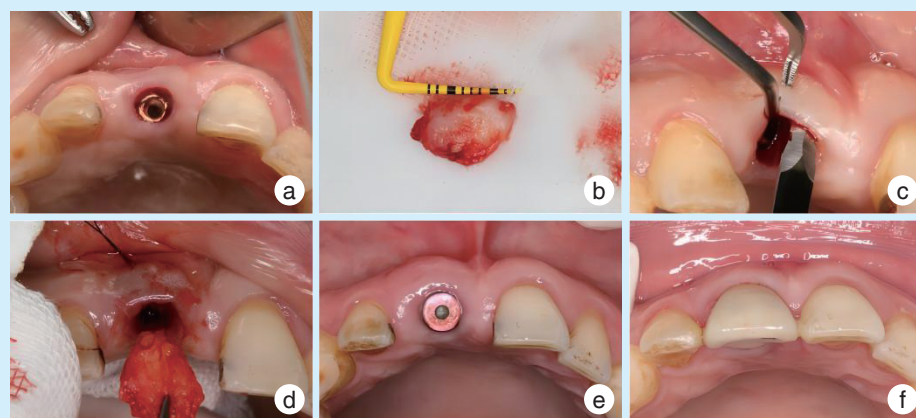
图1 根向复位瓣与游离龈移植联合使用增加角化龈

FGG后,再去除上皮层。直接获取的SCTG因其保留了供区上皮有利于供区一期愈合,减少患者术后反应,而FGG去上皮后得到的结缔组织主要由固有层组成,脂肪组织少,更稳定和具有韧性,也便于后续处理^[31]。

SCTG与冠向复位瓣、侧向滑行瓣、隧道技术等一起使用,可以增加软组织厚度,改善种植位点龈缘退缩,遮掩透露的基台颜色,甚至重建龈乳头,长期维持种植体周组织健康^[31, 35](图2)。近年许多学者开始探讨即刻种植同期移植SCTG的效果^[19-22, 36-37]。Jiang等^[19]在不翻瓣即刻种植同期行SCTG软组织增量,随机对照试验结果表明尽管SCTG不能改变唇侧骨板厚度,但6个月后SCTG组在龈缘下2~5 mm处的唇侧轮廓塌陷程度较对照组均更轻微。根据Fujita等^[20]的研究,即刻种植同期SCTG增量在1年后能够稳定增加1.37 mm软组织厚度,补偿了骨吸收导致的轮廓塌陷,因此保留了术前唇侧丰满度。最近的Meta分析同样证明了在单颗牙即刻种植即刻修复时使用SCTG可以增加唇侧软组织的厚度^[18],且不论是哪种牙龈生物型,都可以减少龈缘退缩这一即刻种植主要并发症^[36]。因此在即刻种植,特别是薄龈生物型和唇侧骨板厚度小于0.5 mm时,推荐同期移植SCTG^[18, 22, 37]。Buser等^[38]在关于种植时机选择时明确提出,即刻种植应选择厚龈生物型且唇侧骨板大于1 mm患者,以避免生物学和美学并发症。即刻种植同期移植SCTG的临床试验纳入的患者仅需要完整的唇侧骨板和提供足够初期稳定性的骨

量即可,结合同期SCTG移植,即刻种植的适应证似乎可以适当放宽,但现有研究随访时间相对较短,此结论仍需更长期大量的临床试验和循证医学证据来证明。

移植SCTG 6个月后,软组织吸收量可高达56%,所以制备SCTG应较实际所需容量更多,这也就导致手术操作时间变长以及术后反应较严重^[39]。随着生物材料的发展,越来越多的研究关注是否可以使用异种胶原基质或脱细胞真皮基质(acellular dermal matrix, ADM)替代自体软组织。有研究表明CM和SCTG增量术后3个月、6个月、1年以及3年的唇侧黏膜厚度和软组织容量变化差异均无统计学意义^[40, 41],在即刻种植使用ADM或自体结缔组织1年后牙龈颜色和PES评分均无明显差别^[21]。Schmitt等^[39]却发现术后6个月CM组唇侧轮廓仅增加0.3 mm, SCTG组增加了0.8 mm。最新的Meta分析也证明SCTG平均能够增加1.17 mm软组织厚度,而CM组仅为0.81 mm, SCTG组平均多增加了0.32 mm,即SCTG较CM能够更好地增加组织厚度^[42]。尽管目前就CM或ADM是否能替代SCTG的结论不一,但可以肯定的是,这些生物材料增加了黏膜的厚度,缩短了治疗时间,减轻了术后不适,对于一些疼痛敏感或厚龈生物型患者,以及经验欠缺的术者,使用生物替代材料进行软组织增量也是一种安全可靠的方案^[43],而寻求一种效果长期稳定的生物替代材料,是软组织增量的未来发展方向。



a: occlusal view of the healed ridge with remaining labial contour collapse after implant placement with simultaneous guided bone regeneration; b: subepithelial connective tissue graft; c: tunneling technique; d: placement of the subepithelial connective tissue graft into the prepared pouch; e: reexamination after 8 weeks; f: occlusal view of the ridge with the final restoration

Figure 2 Volumetric changes at implant sites with subepithelial connective tissue grafts in the esthetic zone

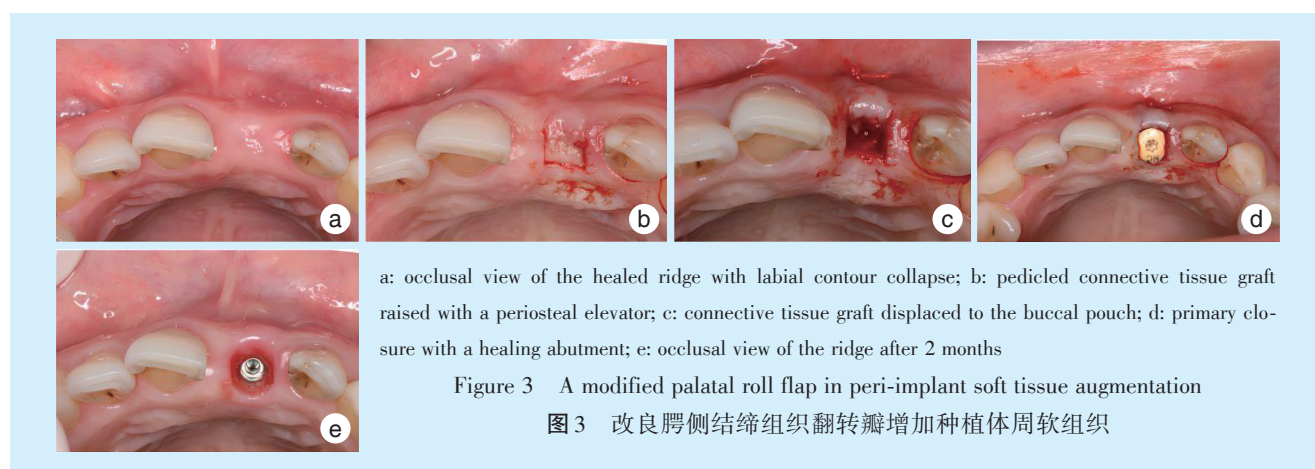
图2 美学区种植位点使用上皮下结缔组织移植后组织量变化

3.3 改良上腭结缔组织翻转技术

上腭结缔组织翻转技术是1980年由Abrams^[44]首先提出,以恢复单颗缺牙位点轻度牙槽嵴缺损,其在上颌缺牙处将腭侧去上皮带蒂结缔组织置入预备好的唇侧骨膜下组织袋内,可以增加颊侧和垂直向的软组织。1992年Scharf等^[45]对Abrams技术进行了改良,将腭侧供区的结缔组织锐性分离,保留供区的薄层黏膜瓣,在结缔组织瓣反折翻转至唇侧后,黏膜瓣可以防止供区牙槽骨的暴露,降低患者的不适。直至1995年,Reikie^[46]将这种改良结缔组织翻转技术应用于种植体基台周围来改善软组织的轮廓外形。

改良上腭结缔组织翻转技术使用的是带蒂腭瓣,血供佳,存活率高,愈合速度更快,移植物挛缩更少,可预期性好(图3)。Padhye等^[47]比较了SCTG和置于唇侧组织的带蒂结缔组织瓣,结果表

明带蒂瓣能够更好地增加种植体唇侧角化龈的厚度,并减轻术后疼痛。Man等^[48]将腭侧带蒂结缔组织翻转后置于唇侧信封瓣内,在术后即刻、1周、3个月、6个月分别比较唇侧轮廓丰满度,不仅唇侧软组织轮廓恢复,而且组织形态稳定,移植物的挛缩和唇侧瘢痕都得到了改善。有临床报道将该技术用于改善Seibert I型骨缺损的轮廓塌陷,最终也获得了稳定且理想的美学效果^[49]。Sclar等^[30]也认可该技术在上颌美学区种植体周轻度软组织塌陷的改善效果,但是考虑到腭侧解剖结构限制,较难获得充足的软组织量,且翻转的结缔组织难以与种植体基台或临时修复体周围形态贴合,所以对于大面积的轻度软组织缺损,更倾向于使用SCTG进行游离移植。因此改良上腭结缔组织翻转技术的临床使用,需综合评估患者轮廓塌陷程度和位置。



3.4 血管化骨膜-结缔组织瓣

Sclar等^[30]为了能够一次性获得大量的软组织,在上腭结缔组织翻转技术的基础上提出了一种长宽比可达5:1的随意型带蒂血管化-结缔组织瓣(vascularized interpositional periosteal-connective tissue graft, VIP-CTG)。它利用切牙孔附近腭大动脉的结缔组织-骨膜血管丛灌注压充足的优势,维持瓣良好的血供,为同期软硬组织增量提供了生物学可能性。

Kim等^[50]报道了3例在美学区即刻或早期种植进行骨增量同期使用VIP-CTG行软组织增量的病例,术后第6年种植位点的唇侧轮廓和龈缘水平仍然非常稳定。VIP-CTG瓣一般用来重建范围相对较大的轻度轮廓塌陷,虽然VIP-CTG和SCTG均能增加在单颗牙缺失伴Seibert I型缺损的位点软

组织,但是带蒂的VIP-CTG在术后6个月挛缩率仅6.4%,显著低于SCTG组(47%),维持软组织轮廓的效果更佳^[51]。Seibert III型骨缺损常需通过软硬组织增量来重建牙槽嵴轮廓,Ferreira等^[52]报道了1例仅用VIP-CTG恢复上前牙连续种植后出现Seibert III型骨缺损的唇侧轮廓美学病例,该病例中患者曾行软硬组织增量失败,不愿再接受常规软硬组织增量手术带来的术后疼痛和再次失败的风险,所以术者使用了VIP-CTG恢复软组织垂直向高度和水平向丰满度,成功重建唇侧轮廓美学,2年后随访,其唇侧轮廓仍然维持稳定。

依靠良好的血供,VIP-CTG可以获得满意的美学效果,但是它的制取也受到腭穹窿形态和腭侧黏膜厚度影响,且因为在唇侧使用了扩大的曲线-斜行切口来容纳瓣,导致唇侧瓣冠向移位,有可能

需要根向复位来重新建立膜龈联合位置^[30],且VIP-CTG的临床长期效果缺乏高质量的大样本临床对照试验结果来证实,因此需谨慎选择合适的病例。

4 总结

面对不可避免的拔牙后轮廓塌陷,软组织移植是解决美学区种植唇侧组织吸收的方法之一。在没有牙槽嵴缺损或仅轻度唇腭向牙槽嵴缺损的种植位点,选择软组织移植可以有效地维持或重建唇侧轮廓美学,也避免了翻瓣后骨增量带来的术后肿胀疼痛以及组织瘢痕,但是对于牙槽嵴严重缺损的患者,仍然建议骨增量术后再根据情况考虑软组织增量。即刻种植时建议同期行软组织增量,早期或延期种植则需根据患者牙槽嵴情况考虑软组织处理时机。软组织增量方法众多,在选择时应综合考虑临床、美学、软组织需求量和患者的要求,以达到理想的唇侧轮廓美学效果。

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