[DOI]10.12016/j.issn.2096-1456.202550229

·专家论坛·

美学区即刻种植长期效果的影响因素及临床决策

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【摘要】 目前，美学区即刻种植的应用日渐广泛，已逐渐成为美学区种植的常规技术之一。要获得良好的美学和长期效果，临床医生需要具备丰富的临床经验及精湛的外科、修复技术。笔者总结了美学区即刻种植长期效果的影响因素：严格把握即刻种植的适应证；术前详细评估患者的全身条件及局部条件，完善美学风险的全面评估；采用微创技术拔除患牙并避免损伤唇侧骨板；选择设计合理的种植体，并依据种植体设计将种植体植入理想的三维位置；依据患牙的软硬组织解剖形态、骨缺损程度及牙周表型选择合理的骨增量及软组织增量技术；设计并不断调整临时修复体的穿龈形态，对软组织进行动态塑形；从健康、功能、美观的视角设计最终修复体；种植治疗完成后加强随访与种植修复的定期维护，对于吸烟、糖尿病、接受抗骨质疏松治疗的患者应加强种植体周维护。笔者诊疗团队提出了美学区即刻种植获得长期稳定临床效果的临床决策方式，为临床医生进行即刻种植的临床决策及治疗提供参考——①经评估为美学风险低的患者：厚龈生物型、无软硬组织缺损、唇侧骨板完整且厚度大于1 mm、无急性感染等，建议微创拔牙后行即刻种植，将种植体植入理想的三维位置；在种植体与唇侧骨壁间隙植骨，酌情行结缔组织移植；②经评估为美学风险中等的患者：薄龈生物型、无软组织缺损、唇侧骨板完整但厚度小于1 mm或存在轻中度骨缺损（高度丧失小于50%）、存在慢性感染等，可微创拔牙后行即刻种植，将种植体植入理想的三维位置；在种植体与唇侧骨壁间隙植骨，或与唇侧骨壁外侧植骨，同期或延期行结缔组织移植；或采用唇侧牙片保留技术进行即刻种植；③对于美学风险高的患者：薄龈生物型、软组织存在缺损，垂直向骨量缺损，唇侧骨板重度缺损（高度丧失大于50%）、存在急性感染等，应拔牙后行位点保存术，延期种植。遵循以上的治疗理念，美学区即刻种植可以获得可靠的成功率和良好的美学效果。

【关键词】 口腔种植；　美学区；　即刻种植；　即刻修复；　微创治疗；　牙周表型；　骨增量；　数字化技术；　长期效果
【中图分类号】 R78　**【文献标志码】** A　**【文章编号】** 2096-1456（2025）09-0719-13
【引用著录格式】 李熠，陆丞，邱立新. 美学区即刻种植长期效果的影响因素及临床决策[J]. 口腔疾病防治，2025, 33(9): 719-731. doi:10.12016/j.issn.2096-1456.202550229.

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Factors influencing long-term outcomes of immediate implantation in the aesthetic zone and clinical decision strategies

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【Abstract】 Immediate implant placement in the aesthetic zone has become increasingly widespread and has gradually evolved into a conventional techniques for implant procedures in the aesthetic region. To achieve favorable aesthetic and long-term outcomes, clinicians must possess extensive clinical experience as well as proficient surgical and restorative skills. This study summarizes the key factors influencing the long-term success of immediate implants in the

【收稿日期】 2025-05-29；　**【修回日期】** 2025-07-20
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aesthetic zone: strict adherence to the indications for immediate implant placement; thorough preoperative assessment of the patient's systemic and local conditions, along with comprehensive evaluation of aesthetic risks; minimally invasive tooth extraction while preserving the integrity of the labial bone plate; selection of appropriately designed implants and their placement in an ideal three-dimensional position based on the implant's characteristics; utilization of suitable bone and soft tissue augmentation techniques according to the patient's specific hard and soft tissue anatomy, extent of bone defects, and periodontal phenotype; dynamic shaping of soft tissues through continuous adjustments in the emergence profile of provisional restorations; design of definitive restorations from the perspectives of health, function, and aesthetics; and implementation of regular follow-up and maintenance protocols after implant treatment, with increased emphasis on peri-implant care for patients who smoke, have diabetes, or undergo anti-osteoporosis therapy. This study proposes a decision-making framework to achieve long-term stable clinical outcomes with immediate implants in the aesthetic zone, providing a reference for clinicians in their clinical decision-making and treatment planning: ① for patients assessed as low aesthetic risk (e.g., thick gingival biotype, absence of hard and soft tissue defects, intact labial bone plate with thickness >1 mm, no acute infection), immediate implant placement after minimally invasive extraction is recommended, with the implant positioned in an ideal three-dimensional location, along with bone grafting in the gap between the implant and the labial bone plate and consideration of connective tissue grafting when required; ② for patients assessed as moderate aesthetic risk (e.g., thin gingival biotype, absence of soft tissue defects, intact labial bone plate but with thickness <1 mm or mild to moderate bone defects involving less than 50% height loss, chronic infection present), immediate implant placement with optimal three-dimensional positioning is feasible, accompanied by bone grafting in the implant-labial bone gap or external bone grafting on the labial aspect, with simultaneous or staged connective tissue grafting, or alternatively, use of the socket shield technique for immediate implant placement; ③ for patients assessed as high aesthetic risk (e.g., thin gingival biotype, presence of soft tissue defects, vertical bone deficiency, severe labial bone loss involving >50% height loss, acute infection present), ridge preservation followed by delayed implant placement is advised. By adhering to these treatment principles, immediate implant placement in the aesthetic zone can achieve reliable success rates and excellent aesthetic outcomes.

【Key words】 dental implants; esthetic zone; immediate implant; immediate loading; minimal invasive therapy; periodontal phenotype; bone augmentation; digital-aided technique; long-term effects

J Prev Treat Stomatol Dis, 2025, 33(9): 719-731.

【Competing interests】 The authors declare no competing interests.

即刻种植指在拔除患牙的同时，立即将种植体植入拔牙窝内的口腔种植技术。1978年Schulte等[1]首次提出了即刻种植的概念。20世纪90年代开始，单颗牙的即刻种植治疗逐渐引起学界关注。国内外研究均表明，单颗牙即刻种植的成功率与常规种植相比无显著差异[2-6]。目前，美学区即刻种植的应用日渐广泛，适应证不断拓宽，已逐渐成为美学区种植的常规技术之一。但是，美学区即刻种植需要临床医师具有丰富的临床经验和精湛的外科、修复技术。要获得良好的美学和长期效果，需要考虑的重要因素包括适应证把握、牙周表型、微创拔牙、牙槽骨轮廓及改建、种植体形态、种植体植入位置、软硬组织增量技术及修复技术等[7]。笔者总结了美学区即刻种植长期效果的影响因素，以期为临床医师进行即刻种植的临床决策提供参考。

1　适应证的把握

2003年，Hammerle等[8]提出了“四个种植时机”的理论（即刻种植、软组织愈合早期种植、部分骨组织愈合早期种植、延期种植）。2013年，在瑞士伯尔尼召开的第五届国际口腔种植学会（International Team for Implantology，ITI）共识会议上，Chen和Buser[9]提出了即刻种植的适应证：①缺牙区唇侧骨板完整且厚度大于1 mm；②厚龈生物型；③牙槽窝无急性感染；④根尖区有足够骨量保证种植体的理想三维位置和初期稳定性。

但是，临床上能够满足上述条件的病例并不多见。Braut等[10]研究结果表明，只有4.6%~11.5%的美学区牙齿唇侧骨板厚度大于1 mm。Chen等[9]的研究结果表明，52%的中切牙在微创拔除后仍可见唇侧骨开窗或开裂。Kan等[11]研究结果表明，如果即刻种植后唇侧骨板存在明显缺损，术后1年

唇侧出现大于1.5 mm龈退缩的风险将明显提高，进而影响美学效果。

2025年，Cardaropoli等[12]发表了专家共识建议，对于唇侧骨壁完整的拔牙窝首选即刻种植，并根据牙周表型决定是否行软组织增量手术。唇侧骨壁轻中度受损（高度丧失<50%）的牙槽窝首选早期种植体植入（拔牙后6～8周）和骨增量手术。而对于唇侧骨壁重度受损、患者因各种原因暂无法接受种植治疗的患者，可采取牙槽嵴保存并延期种植的治疗策略。

2　术前美学风险评估（单牙/多牙）

术前完善的美学风险评估（esthetic risk assessment，ERA）是获得良好治疗效果、完善医患交流的先决条件。术前美学风险评估包括整体和局部条件的检查。

整体条件包括患者全身情况和依从性的检查。目前研究表明，一些全身性疾病或生活习惯如糖尿病[13]、吸烟[14]、骨质疏松症[15]、使用抗骨质吸收和抗血管生成药物[16-17]、接受放射治疗[18]等情况可能增加手术并发症出现风险，影响种植体骨结合或影响种植体周软组织长期健康。

局部条件包括笑线、牙周表型、牙冠形态、是否有急性感染、邻牙骨高度、邻牙是否为修复体、缺牙区宽度、缺失牙数目、软硬组织解剖等。Chen等[9]提出的术前美学风险评估量表在临床工作中非常有指导意义（表1）。

表1　术前美学风险评估量表[9]

Table 1　Preoperative aesthetic risk assessment scale[9]

Aesthetic risk factors	Low	Medium	High
Medical status	Healthy and intact immune system		Compromised immune system
Smoking status	Non-smoker	Light smoker	Heavy smoker
		<10 cigarettes a day	> 10 cigarettes a day
Patient's aesthetic expectations	Low	Medium	High
Lip line	Low	Medium	High
Periodontal phenotype	Low scalloped	Medium scalloped	High scalloped
	Thick	Medium thick	Thin
Shape of tooth crowns	Rectangular	Slightly triangular	Triangular
Infection at implant site	None	Chronic	Acute
Bone level at adjacent teeth	≤5 mm to contact point	5.5 – 6 mm to contact point	> 7 mm to contact point
Width of edentulous span	1 tooth ≥ 7 mm	1 tooth ≤ 7 mm	2 teeth or more
Soft tissue anatomy	Intact soft tissue		Soft tissue defects
Bone anatomy of alveolar crest	No bone deficiency	Horizontal bone deficiency	Vertical bone deficiency

3　微创拔牙

在美学区即刻种植的病例中，推荐使用不翻瓣的微创拔牙技术。Fickl等[19]的研究表明，与翻瓣拔牙相比，不翻瓣微创拔牙对减少骨板进一步吸收非常重要，不翻瓣拔牙可以减少拔牙后早期愈合阶段（4~8周）的骨吸收。而Tavelli等[20]却认为，翻瓣是否会增加拔牙后唇侧的骨吸收尚存在争议。在精细的翻瓣后进行拔牙，视野更清晰，软组织损伤更小，亦可降低种植体植入位置不正确的风险，更便于识别需进行软硬组织增量的区域。在拔牙过程中，应避免对牙齿施加唇向的作用力。某些微创拔牙工具如超声骨刀、垂直拔牙装置也可以减少拔牙过程中的创伤。如果没有上述工具，可以采用颊舌向分根、分片挺出的方式拔牙。先挺出舌侧牙片，再通过舌向轻敲法分离取出唇侧牙片，或保留唇侧牙片，避免唇侧骨板受力。

4　种植体植入的三维位置

种植体植入的三维位置包括近远中向位置及唇舌向位置（水平面）、植入角度（矢状面）、植入深度（矢状面）三个方面。在美学区即刻种植中，种植体植入的近远中位置相对容易把握，即种植体与近远中牙齿釉牙骨质界距离至少1.5 mm。而考虑到初期稳定性，上颌种植体植入的定点位置应在牙槽窝腭侧骨板的冠方1/3～中1/3范围内，最终使植入的种植体占据腭侧骨壁[21]。确定植入的位置后，植入角度的确定也非常关键。考虑到长期美学效果、口腔卫生维护等因素，目前认为理想的

美学区种植体植入长轴角度为沿天然牙切端位置或沿切端稍偏腭侧，即种植体紧贴腭侧骨板植入。过于唇倾的种植体更可能导致唇侧牙龈退缩[22]。理想状态下，种植体颈部平台位置一般控制在游离龈缘或未来牙冠颈缘根方3~4 mm。

在即刻种植手术中，种植医生需要将患者的解剖结构、自身的临床知识与临床技术相结合，以获得良好的种植体植入效果。研究表明，种植体植入过程中发生的植入位置偏差主要源于手术经验不足与术中精力不集中[23]。而在不翻瓣手术中，由于医生无法直视观察牙槽骨的结构，这类偏差可能会被放大[24]。近年来，数字化导板和动态导航技术在美学区种植中的应用越来越广泛[25-29]。研究表明，使用数字化导板技术及动态导航技术进行单牙种植的深度偏差、角度偏差及三维位置偏差均较自由手种植更小[30-32]。提示对于经验欠丰富的种植医生，使用数字化技术辅助种植外科手术可能获得更精准的治疗效果[33-35]。

5　种植体直径及颈部设计的选择

在美学区即刻种植后，唇侧骨板会出现一定程度的骨改建[36]。为了补偿唇侧骨板的改建与吸收，获得长期稳定的美学效果，种植体植入后应与唇侧骨板间至少保持2 mm的间隙，并用低替代率的骨替代材料填充。Levine等[37]认为，种植体与唇侧骨板之间保留3 mm间隙的长期美学效果更佳。因此，与使用直径较粗的种植体（4.5~5.0 mm）相比，使用直径较细的种植体（3.3~4.1 mm）更易获得长期稳定的临床效果。Araújo等[38]的一项研究表明，美学区即刻种植使用3.3 mm种植体的唇侧垂直向骨吸收量（0.05 mm）显著低于使用4.1 mm种植体（2.5 mm）。但是更细的种植体（≤ 3.5 mm）也存在局限性，例如，需要更深的植入深度以保证穿龈区的形态过渡，可能产生更多的边缘骨吸收；种植体-骨接触面积小，更难获得初期稳定性；种植体-基台连接处更细，种植体与基台的强度及连接的稳定性均受到挑战[39]。因此，在保证种植体-唇侧骨板存在2~3 mm间隙的前提下，种植体直径的选择需综合考虑缺牙区牙槽嵴软硬组织形态。如患者的牙槽骨形态及骨缺损程度无法保证将合适直径的种植体植入合理的深度并获得良好的初期稳定性，则需考虑采用早期种植或延期种植的治疗策略[12]。

种植体颈部设计主要包括颈部粗糙程度和种植体-基台连接方式两方面。种植体颈部粗糙度设计主要分为机械加工表面（光滑颈部）和中等粗糙表面。有研究表明，将光滑颈部放置于骨下与早期嵴顶骨改建明确相关[40-45]。应避免将种植体光滑颈部置于骨下过深。而在种植体负重后，稳定的软组织封闭对种植体的长期健康非常重要。有研究表明，位于骨上的光滑颈圈有利于上皮及结缔组织的附着，而位于骨上的中等粗糙表面菌斑定植更容易[46-47]。种植体-基台连接方式主要包括外连接、平台对接内连接或内外双重连接和平台转移内连接。有研究表明，平台转移的种植体可以减少种植体周围的边缘骨吸收[40]。但平台转移设计在降低边缘骨吸收风险的同时，可能导致应力向内集中，基台及中心螺丝折断的风险增加[48]。此外，种植体与基台稳定的连接可以降低微间隙对种植体长期健康的影响，对种植体长期稳定非常重要[49-50]。有研究表明，内连接种植体的稳定性优于外连接。在内连接中，莫氏锥度内连接（锥度2°~4°）的稳定性优于大锥度内连接（锥度5°~20°）或平面连接（锥度大于20°）[51]。内外连接相结合的设计可能获得更稳定的种植体-基台连接效果[52]。对于连接不稳定的种植体，种植体植入位置越深，越易因微渗漏导致种植体周组织炎症反应或骨吸收。

此外，对美学区即刻种植-即刻负重的病例，选择亲水或超亲水种植体有利于早期快速的骨结合，对于骨条件差、糖尿病、骨质疏松等患者优势尤为突出[53-54]。

6　骨增量技术

Chappuis等[55]的研究结果表明，当拔牙后的牙槽窝唇侧骨壁完整且厚度大于1 mm的情况下，在后期骨改建过程中将出现平均1.1 mm或9%的垂直向骨量丧失；而当唇侧骨壁厚度小于1 mm时，将出现平均7.5 mm或62%的垂直向骨量丧失。Araújo等[38]的研究结果表明，即刻种植后3个月，牙槽窝唇侧垂直向骨吸收平均2.6 mm，即刻种植并不能阻止牙槽窝唇侧骨板的吸收改建。因此，美学区即刻种植中的骨增量程序在多数临床病例中是必要的。

当唇侧骨板完整且厚度大于1 mm的情况下，应在种植体与唇侧骨板之间的间隙内植入低替代率的骨替代材料来维持唇侧骨轮廓。当唇侧骨板厚度小于1 mm或存在骨开窗、骨开裂时，应谨慎

考虑是否行单纯即刻种植，并考虑即刻种植同时行引导骨再生、或行早期或延期种植。

近年来，随着唇侧牙片屏障技术[56-57]、即刻种植同期翻瓣引导骨再生等骨增量/骨保存理念的出现，以往一些不满足即刻种植适应证的病例也可以通过即刻种植获得良好的美学效果[58]。但这些技术往往存在较高的技术敏感性，临床效果尚需长期随机对照研究的进一步验证。图1展示了20岁男性患者因外伤致左上中切牙至尖牙冠根折的病例。考虑到左上尖牙位于牙弓转角区，属于潜在的不利型骨缺损区域。因此作者团队对左上中切牙采用了即刻种植及间隙植骨技术，对左上尖牙采用了牙片屏障技术进行即刻种植即刻修复。术后5年取得了良好且稳定的美学效果，但因患者颅颌面发育出现了左上前牙与右上前牙轻微不齐的情况。该问题在本文第10部分将详细描述。

7　软组织增量的技术和时机

牙周表型可以影响美学区即刻种植的长期效果[59-60]。Kan等[61]的研究结果表明，在接受美学区即刻种植2~8年后，薄龈型患者种植体唇侧龈退缩平均1.50 mm，而厚龈型仅0.56 mm。即刻种植同期对薄龈型患者（平均唇侧牙龈厚度0.6 mm）行唇侧上皮下结缔组织移植，2年后的唇侧牙龈水平与厚龈型即刻种植患者（平均唇侧牙龈厚度2.3 mm）无差异。Linkevicius等[62]对非美学区种植的研究结果也表明，若牙槽嵴顶牙龈厚度小于2 mm，种植后1年边缘骨吸收约1.65 mm，若牙槽嵴顶牙龈厚度大于2 mm或行结缔组织移植，种植后1年边缘骨吸收约0.31~0.44 mm。因此，美学区即刻种植需评估牙周表型。针对薄龈生物型患者，Stefanini等[63]推荐即刻种植同期采用隧道技术行上皮下结缔组织移植，对美学区即刻种植的长期美学效果有积极意义。Zucchelli等[64-65]推荐对于薄龈生物型患者，即刻种植同时进行微创翻瓣，骨增量后将结缔组织移植物缝合固定于唇侧瓣内侧并行唇颊侧瓣冠向复位缝合。作者团队对1例因外伤导致中切牙根折的28岁男性患者行即刻种植+结缔组织移植术，术后5年取得了稳定美学效果（图2）。

8　种植修复体穿龈轮廓对软组织的引导与成型

种植修复穿龈轮廓指种植体肩台至牙龈边缘所创造的轮廓，对最终修复体的外形轮廓起主导作用，并影响种植体周围的软组织支持效果。Grunder等[66]认为，种植修复的穿龈轮廓应尽量复制天然牙的穿龈轮廓。但由于种植体的植入位置、角度与直径往往与天然牙存在差别，因此种植修复穿龈轮廓对软组织的引导与成型非常重要。

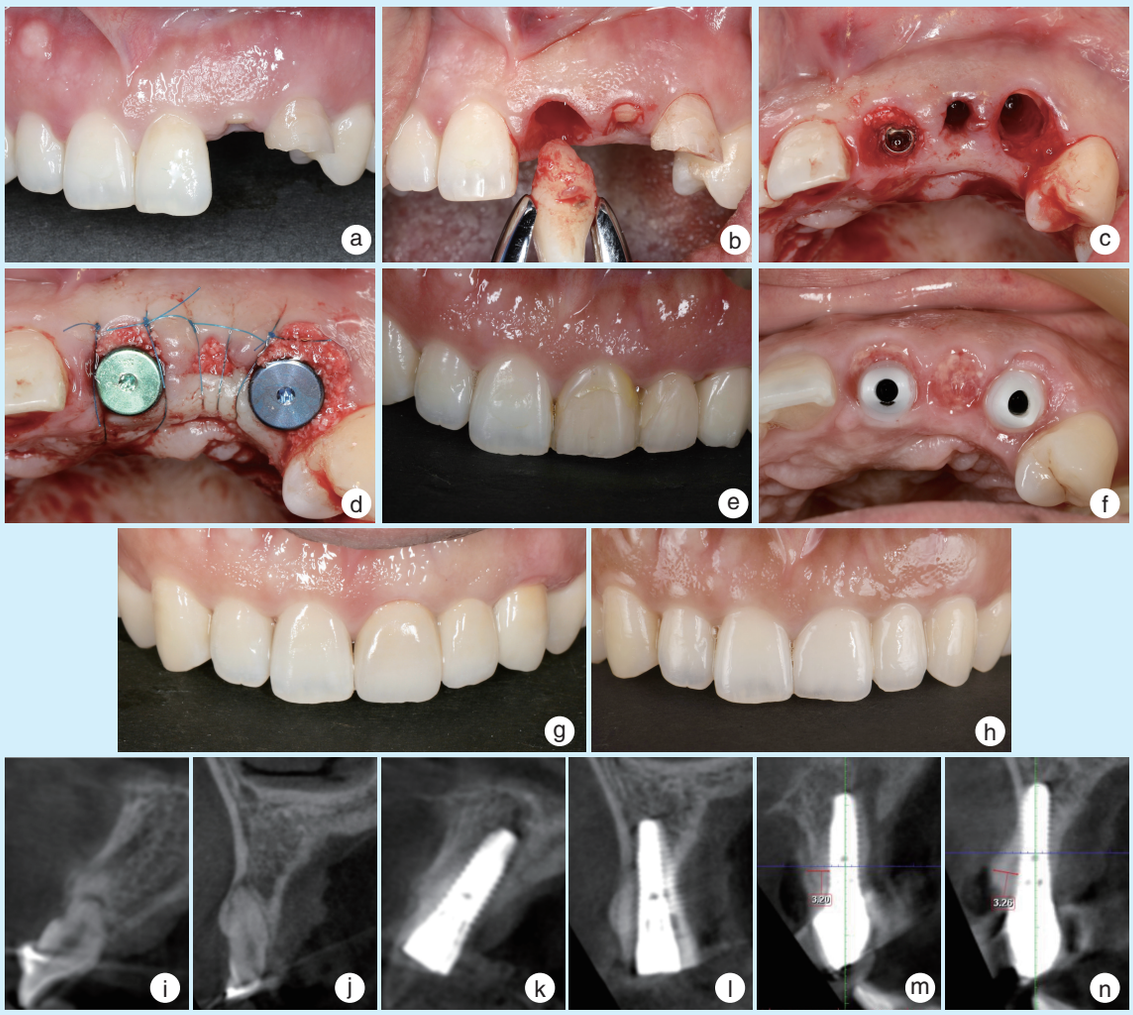
种植修复的穿龈轮廓包括龈缘区（龈缘根方1 mm以内）和龈缘下区（龈缘根方1 mm以外）两部分，其中龈缘下区的形态对软组织的引导和成型最重要。Grunder等[66]认为，平台转移种植体龈缘下区的凹陷形态可以为血凝块创造空间，提供软组织生长、增厚的空间。Schoenbaum等[67]的研究结果表明，基台与唇侧骨板之间应至少存在2 mm距离，减少边缘骨吸收，临时修复的龈缘下区应做成凹型，为软硬组织创造足够的空间，待软组织成熟后（至少4周）再进行软组织塑形。Katafuchi等[68]的研究结果表明，大于30°的穿龈角度和凸起型穿龈轮廓可提高种植体周围炎的发生率。

而在软组织愈合成熟后，在对软组织进行塑形以及永久修复的过程中，龈缘下区的形态设计还需要考虑种植体的直径和位置。当种植体位置偏唇侧或种植体直径较大，则设计凹陷的龈缘下区以增加软组织的厚度；当种植体位置居中，则设计微凹陷的龈缘下区以维持软组织形态；当种植体位置偏腭侧或种植体直径较小，则采用微凸的龈缘下区以给予唇侧软组织足够的支撑，而龈缘区则尽量参照天然牙的形态设计制作[69]。

9　临时修复体与最终修复体的设计

9.1　临时修复体的设计要点

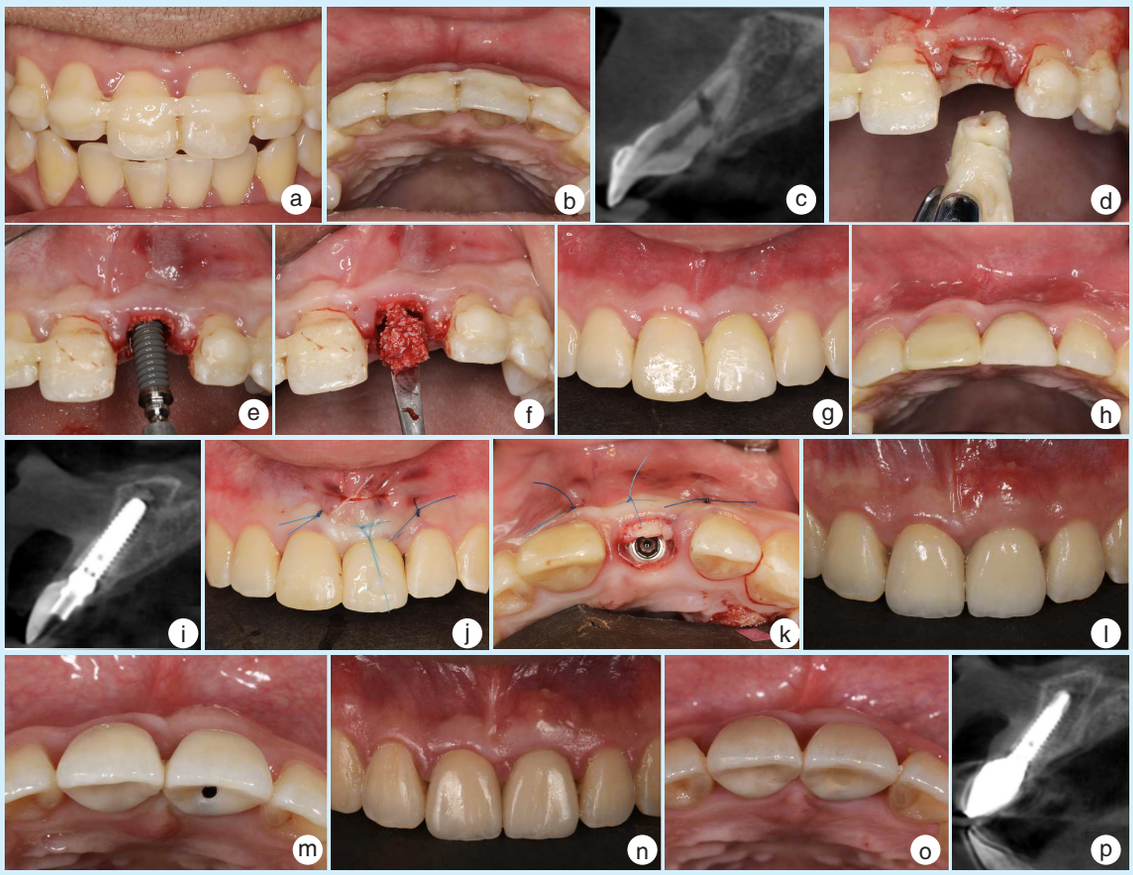
当美学区即刻种植可以获得理想的初期稳定性时，使用螺丝固位的即刻临时修复不仅有利于软组织支撑，也有利于创口和植骨材料的封闭，对美学效果具有积极意义。通常，为了保证种植体稳定的愈合环境以获得理想的骨结合，即刻临时修复体应在正中、前伸及侧方咬合均无咬合接触。必要时应磨除切缘1~2 mm修复体，虽然损失了一定程度的美学效果，但可以较好地保证种植体的稳定愈合。对于前牙区深覆𬌗患者，可适当调磨对颌牙，以减小临时及正式修复阶段的咬合风险，必要时也可以采用具有良好穿龈形态的个性化愈合基台，仍能取得与即刻修复临时冠类似的牙龈塑形效果。即刻临时修复穿龈形态的关键区设计应为略凸形，以维持适当的软组织张力，但不应出现对软组织的明显压迫，否则会导致愈合过程中的龈缘退缩；次关键区域应设计成略凹形，避



a: traumatic crown-root fractures of the left maxillary central incisor to canine, requiring extraction and implant restoration. b: minimally invasive extraction of the affected teeth, preserving the integrity of the buccal bone plate. c & d: for the left maxillary central incisor, the osteotomy was initiated at the coronal third of the palatal bone wall, closely adhering to the palatal bone. The implant was placed in an ideal three-dimensional position, and the gap between the implant and the buccal bone plate was grafted with bone substitute material (Bio-Oss Collagen, Geistlich, USA). The left maxillary lateral incisor was extracted using a minimally invasive method, and the socket was filled with bone substitute material (ridge preservation). For the left maxillary canine, the buccal socket shield was prepared and retained. The osteotomy was initiated at the coronal third of the palatal bone wall, closely adhering to the palatal bone. The implant was placed in an ideal three-dimensional position, and the gap between the implant and the retained buccal socket shield was grafted with Bio-Oss Collagen (Geistlich, USA). e: a provisional crown was fabricated postoperatively to seal the grafted area. The tissue healed well after 2 weeks. f: from immediate placement to 4 months postoperatively, a temporary prosthesis was used for soft tissue contouring. The image was taken before the impression process of the definitive prothesis. g: at 4 months postoperatively, the definitive prosthesis was delivered. h: at 5 years postoperatively, the aesthetic outcome of the implant restoration remained stable and satisfactory. i: preoperative CBCT sagittal view of the left maxillary central incisor. Horizontal root fracture was observed at the middle of the root. j: preoperative CBCT sagittal view of the left maxillary canine. Vertical crown and root fracture extended to the apical of the palatal alveolar bone crest. k: immediate postoperative CBCT sagittal view of the left maxillary central incisor. The labial alveolar bone wall had a thickness greater than 2 mm. l: immediate postoperative CBCT sagittal view of the left maxillary canine. The labial socket shield had a thickness greater than 2 mm. m: 5-year postoperative CBCT sagittal view of the left maxillary central incisor. The labial alveolar bone wall exhibited a stable height with a thickness greater than 2 mm. n: 5-year postoperative CBCT sagittal view of the left maxillary canine. The labial alveolar bone wall exhibited a stable height with a thickness greater than 2 mm

Figure 1　Procedures and follow-up images of immediate implant placement in a 20-year-old male patient with traumatic crown-root fractures of the left maxillary central incisor to canine

图1　外伤致左上中切牙至尖牙冠根折20岁男性患者拔牙后即刻种植手术过程及随访照片



a: preoperative intraoral labial view showing traumatic root fracture of the left maxillary central incisor. b: preoperative intraoral occlusal view. c: preoperative CBCT sagittal image of the left maxillary central incisor, revealing a horizontal fracture at the apical third of the root. d: minimally invasive extraction preserving the integrity of the buccal bone plate. e: osteotomy initiated at the coronal third of the palatal bone wall, following the palatal contour for implant placement in an ideal three-dimensional position. f: gap between the implant and buccal bone plate grafted with Bio-Oss Collagen (Geistlich, USA) and immediate provisionalization. g: 2-month postoperative labial view demonstrating favorable soft tissue healing, with the gingival margin 0.5 mm apical compared to the contralateral incisor. h: 2-month postoperative occlusal view revealing inadequate tissue contour volume. i: 2-month postoperative CBCT sagittal image. The position of the buccal bone crest showed no significant reduction compared to the preoperative state. j: a flapless connective tissue graft was performed to improve the position of the buccal gingival margin with subepithelial connective tissue graft (SCTG) harvested from the left palate and transplanted to the buccal aspect at 2 months post-implantation. k: immediate postoperative occlusal view showing the SCTG positioned buccal to the implant. l: 2-week post-grafting labial view demonstrating coronal migration of the gingival margin. m: 2-week post-grafting occlusal view showing improved tissue contour volume. n: 5-year postoperative labial view demonstrating stable gingival margin position and tissue contour. o: 5-year postoperative occlusal view demonstrating stable gingival margin position and tissue contour. p: 5-year postoperative CBCT sagittal image. The labial alveolar bone wall exhibited a stable height with a thickness greater than 2 mm

Figure 2　Procedures and follow-up photos of immediate implant placement with connective tissue grafting in a 28-year-old male patient with traumatic root fracture of the maxillary central incisor

图2　外伤致中切牙根折28岁男性患者行即刻种植+结缔组织移植术手术过程及随访照片

免压迫软组织移植物或者骨替代材料，给软组织生长提供足够的空间，以保证愈合后的软组织厚度[70]。

对于不满足即刻临时修复条件的病例，推荐使用双侧末端磨牙卡环固位的可摘局部义齿或利用双侧邻牙固位的马里兰桥来支撑缺牙区软组织并封闭创口。

9.2　最终修复体的设计要点

最终修复体设计对美学区即刻种植长期效果的影响主要表现在种植体-基台连接的边缘封闭和微动度、反复摘戴基台、基台的形态与材料以及种植体-基台连接方式等方面。使用原厂基台及配件有助于减少种植体-基台的边缘封闭与微动度。为了避免反复摘戴基台，即刻种植同期可直接戴入

个性化制作的永久基台或戴入符合龈缘下区形态设计原则的预成永久基台，只通过冠部结构对软组织进行塑形。Degidi等[71]的研究结果表明，与传统修复方式相比，使用预成永久基台技术可在6个月~1年的随访中显著减少种植体周围边缘骨吸收。

对于无法在即刻种植同期安装永久基台的情况，若可以使用螺丝固位修复，可选择基台一体冠设计，在口外对基台和牙冠进行粘接，避免粘接剂残留。若使用粘接固位修复，则个性化基台边缘应尽量设计在龈缘根方1 mm以内，降低粘接剂去除的难度，并尽量避免使用X线透射的粘接剂。

10　随访与长期维护

种植修复完成后的随访与维护治疗是预防种植修复生物学并发症的重要手段，是积极治疗理念的延伸，对美学区种植的长期效果具有重要作用。维护期治疗方案包括患者自我维护与专业维护[72-75]。

由于美学区口腔卫生维护的难度相对较低，自我维护推荐使用牙刷+牙间隙刷+冲牙器的组合。应为患者个性化选择牙间隙刷的直径，避免损伤牙龈乳头的完整性。使用牙线进行种植体清洁后应观察牙线完整性有无损坏。van Velze等[76]报道多例牙线纤维残留引起的种植体周围炎的案例。患颞下颌关节紊乱综合征或功能异常患者的自我维护，还包括配戴殆垫保护咬合，从而减少机械并发症的发生风险[77-78]。

推荐种植体植入后第1年内每3~4个月复诊1次，之后每年复诊1次。存在种植体周围病的患者每3~4个月复诊1次。种植患者维护期复诊时应特别注意咬合检查，必要时调整咬合，根据每例患者的特殊情况制定和修改治疗方案[79-80]。如观察到种植体周软组织红肿、出血、探诊深度大于6 mm或较前进行性加深，影像学检查见种植体周骨吸收等现象，则应对种植体周围病进行明确诊断，并采取相应的治疗措施[81]。治疗方法包括种植体周非手术治疗、翻瓣术或骨成型术、种植体周硬组织再生性手术、软组织移植手术等[82-84]。

某些系统性疾病及不良生活习惯可能影响种植修复的长期效果，需要临床医生在进行种植随访及长期维护时予以关注。有研究表明，吸烟会降低牙槽嵴增量术后的种植体存留率[14, 85]。临床医生应在种植维护期内持续鼓励患者戒烟或降低吸烟量。此外，接受抗骨质吸收治疗的患者同样需要关注。Pichardo等[17]的研究表明，在接受双膦酸盐类药物治疗的患者，已经植入并发生骨结合的种植体如果伴有种植体周围炎，其发生药物相关性颌骨坏死的风险会显著增加，下颌骨更易受累。因此，对此类患者更应加强种植随访与维护，降低种植体周围炎发生率，进而降低更复杂的颌骨坏死风险。目前研究表明，糖尿病不是种植治疗的绝对禁忌证，但与健康患者相比，糖尿病患者的种植体存留率可能略低，种植体失败率较高，这一趋势在长期随访中尤为显著[86]。因此在糖尿病患者的种植随访中应关注患者血糖状态，鼓励患者积极控制血糖。

此外，终生颅面发育对骨结合种植体的影响也应引起重视。Forsberg等[87]对30例25岁青年进行为期20年的随访观察，在观察期内发现，30名观察对象的前面部高度平均增加1.6 mm，同时伴随上前牙的直立和下颌骨的后向旋转。随着年轻患者的颅面部发育，上前牙种植体可能会出现“下沉”、“颊倾”的表象，并有可能与邻牙出现间隙[88]。该问题可通过更换修复体得以改善。因此，年轻患者即刻种植的长期美学效果将受到更大的挑战。需要注意的是，目前对于美学区即刻种植美学效果的长期观察尚不多见。Chen等[9]的系统综述结果显示，与早期种植相比，美学区即刻种植后1~3年的随访中有26.7%的位点出现了大于1 mm的影响美学效果的唇侧牙龈退缩。尽管即刻种植同期进行了骨增量，仍有36%~57%的位点在锥形束CT检查中看不到唇侧骨板。Kan等[61]的研究结果也显示，美学区即刻种植的效果受牙周表型的影响较大，呈现较高的变异性[61]。

11　美学区即刻种植获得稳定长期效果的临床决策建议

综上，作者团队总结了美学区即刻种植获得稳定长期效果的临床决策建议（图3），证据采集、证据级别判定及临床建议强度采用牛津证据质量分级系统标准分类[89-93]，对于美学区即刻种植的潜在病例，应先对患者进行适应证及美学风险评估。

①经评估为美学风险低的患者：厚龈生物型、无软硬组织缺损、唇侧骨板完整且厚度大于1 mm、无急性感染等，建议微创拔牙后行即刻种植，将种植体植入理想的三维位置（证据等级：1a，推荐强度：A级，强推荐）。在种植体与唇侧骨壁间隙植骨（证据等级：2a，推荐强度：B级，中等推荐），酌情行

结缔组织移植(证据等级:2b,推荐强度:C~D级,弱推荐~经验性推荐)。

②经评估为美学风险中等的患者:薄龈生物型、无软组织缺损、唇侧骨板完整但厚度小于1 mm或存在轻中度骨缺损(高度丧失小于50%)、存在慢性感染等,可微创拔牙后行即刻种植,将种植体植入理想的三维位置(证据等级:2a,推荐强度:A级,强推荐)。在种植体与唇侧骨壁间隙植骨(证据等级:2a,推荐强度:B级,中等推荐),或与唇侧骨壁外侧植骨(证据等级:3a,推荐强度:C级),同期或延期行结缔组织移植(证据等级:2b,推荐强度:B级,中等推荐)。或采用唇侧牙片保留技术进行即刻种植(证据等级:3a,推荐强度:C级,弱推荐)。

③经评估为美学风险高的患者:薄龈生物型、软组织存在缺损、垂直向骨量缺损、唇侧骨板重度缺损(高度丧失大于50%)、存在急性感染等,应拔牙后行位点保存术,延期种植(证据等级:2a,推荐强度:B级,中等推荐)。

遵循以上的治疗理念,美学区即刻种植可以获得可靠的成功率和良好的美学效果。

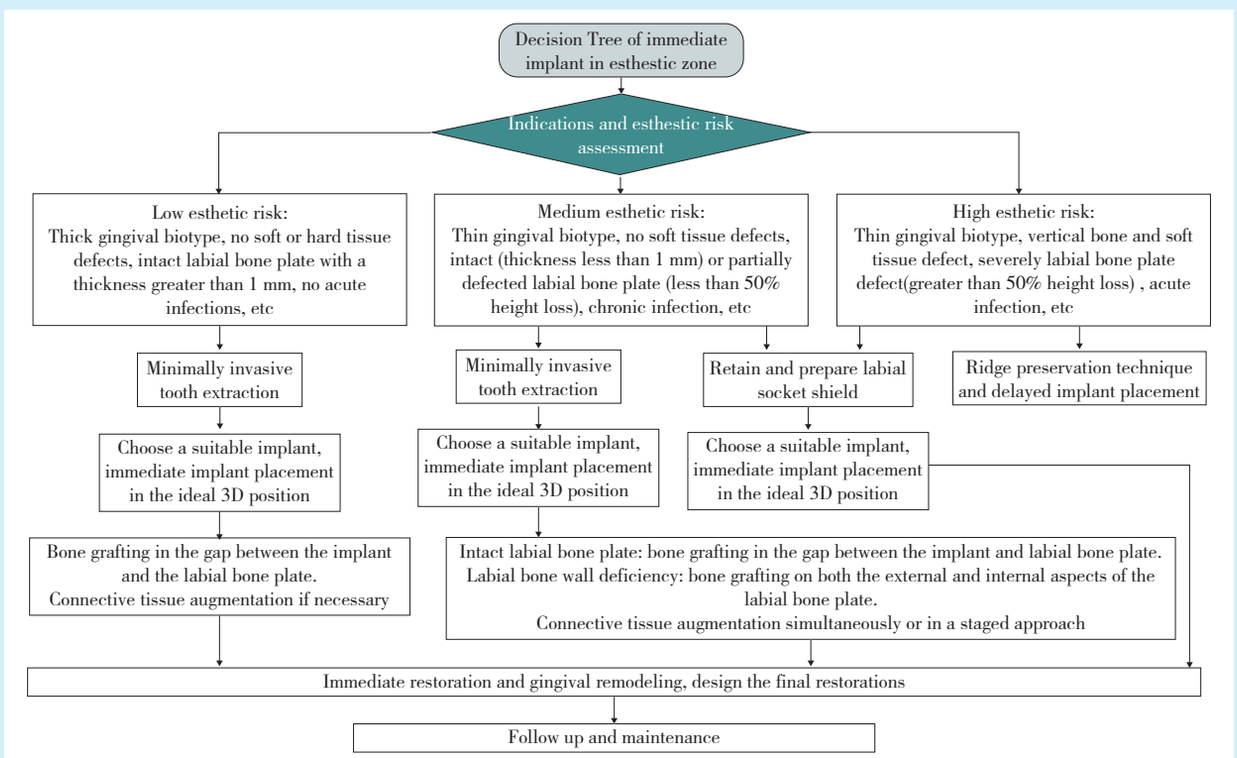


Figure 3　Clinical decision for achieving stable long-term aesthetic outcomes with immediate implant in the aesthetic zone

图3　美学区即刻种植获得稳定长期美学效果的临床决策

【Author contributions】 Li Y wrote original draft. Lu C was responsible for clinical case treatment and data collection. Qiu LX performed-clinical case treatment and data collection, critical review of the intellectual content. All authors read and approved the final manuscript submitted.

参考文献

[1] Schulte W, Kleineikenscheidt H, Schareyka R, et al. Concept and testing of the tübingen immediate implant[J]. Dtsch Zahnarztl Z, 1978, 33(5): 319-325.

[2] Rosenquist B, Grenthe B. Immediate placement of implants into extraction sockets: implant survival[J]. Int J Oral Maxillofac Implants, 1996, 11(2): 205-209.

[3] Grunder U, Polizzi G, Goené R, et al. A 3-year prospective multicenter follow-up report on the immediate and delayed-immediate placement of implants[J]. Int J Oral Maxillofac Implants, 1999, 14(2): 210-216.

[4] 邸萍, 林野, 邱立新, 等. 牙种植即刻修复的临床研究[J]. 中华口腔医学杂志, 2004, 39(4): 265-268. doi: 10.3760/j.issn: 1002-0098.2004.04.001.
Di P, Lin Y, Qiu LX, et al. Immediate loading of dental implants in partialful edentulous and edentulous jaws[J]. Chin J Stomatol, 2004, 39(4): 265-268. doi: 10.3760/j. issn: 1002-0098.2004.04.001.

[5] 欧国敏, 宫苹, 陈文川, 等. 即刻种植与即刻修复的临床应用[J]. 中华口腔医学杂志, 2006, 41(3): 144-147. doi: 10.3760/j.

issn: 1002-0098.2006.03.005.
Ou GM, Gong P, Chen WC, et al. A clinic study of immediate dental implant and immediate restoration[J]. Chin J Stomatol, 2006, 41(3): 144-147. doi: 10.3760/j.issn: 1002-0098.2006.03.005.

[6] 邱立新, 林野, 李健慧, 等. 微创拔牙即刻种植的牙龈美学效果观察[J]. 中华口腔医学杂志, 2007, 42(11): 647-650. doi: 10.3760/j.issn: 1002-0098.2007.11.003.
Qiu LX, Lin Y, Li JH, et al. Minimally invasive extraction and immediate implant placement with single-stage surgical procedure: a clinical observation of 21 cases[J]. Chin J Stomatol, 2007, 42(11): 647-650. doi: 10.3760/j.issn: 1002-0098.2007.11.003.

[7] Buser D, Chappuis V, Belser UC, et al. Implant placement post extraction in esthetic single tooth sites: when immediate, when early, when late? [J]. Periodontol 2000, 2017, 73(1): 84-102. doi: 10.1111/prd.12170.

[8] Hämmerle CH, Chen ST, Wilson TG Jr. Consensus statements and recommended clinical procedures regarding the placement of implants in extraction sockets[J]. Int J Oral Maxillofac Implants, 2004, 19 Suppl: 26-28.

[9] Chen ST, Buser D. Esthetic outcomes following immediate and early implant placement in the anterior maxilla - a systematic review[J]. Int J Oral Maxillofac Implants, 2014, 29 Suppl: 186-215. doi: 10.11607/jomi.2014suppl.g3.3.

[10] Braut V, Bornstein MM, Belser U, et al. Thickness of the anterior maxillary facial bone wall-a retrospective radiographic study using cone beam computed tomography[J]. Int J Periodontics Restorative Dent, 2011, 31(2): 125-131.

[11] Kan JY, Rungcharassaeng K, Sclar A, et al. Effects of the facial osseous defect morphology on gingival dynamics after immediate tooth replacement and guided bone regeneration: 1-year results[J]. J Oral Maxillofac Surg, 2007, 65(7 Suppl 1): 13-19. doi: 10.1016/j.joms.2007.04.006.

[12] Cardaropoli D, Araujo M, Buser D, et al. Treatment options for the management of the postextraction socket: report from the first giuseppe cardaropoli foundation consensus conference[J]. J Periodontal Res, 2025, 60(5): 398-416. doi: 10.1111/jre.13385.

[13] Al Ansari Y, Shahwan H, Chrcanovic BR. Diabetes mellitus and dental implants: a systematic review and meta-analysis[J]. Materials(Basel), 2022, 15(9): 3227. doi: 10.3390/ma15093227.

[14] Naseri R, Yaghini J, Feizi A. Levels of smoking and dental implants failure: a systematic review and meta-analysis[J]. J Clin Periodontol, 2020, 47(4): 518-528. doi: 10.1111/jcpe.13257.

[15] Goiato MC, dos Santos DM, Santiago JF Jr, et al. Longevity of dental implants in type IV bone: a systematic review[J]. Int J Oral Maxillofac Surg, 2014, 43(9): 1108-1116. doi: 10.1016/j.ijom.2014.02.016.

[16] Sher J, Kirkham-Ali K, Luo JD, et al. Dental implant placement in patients with a history of medications related to osteonecrosis of the jaws: a systematic review[J]. J Oral Implantol, 2021, 47(3): 249-268. doi: 10.1563/aaid-joi-D-19-00351.

[17] Pichardo SEC, van der Hee JG, Fiocco M, et al. Dental implants as risk factors for patients with medication-related osteonecrosis of the jaws (MRONJ)[J]. Br J Oral Maxillofac Surg, 2020, 58(7): 771-776. doi: 10.1016/j.bjoms.2020.03.022.

[18] Shokouhi B, Cerajewska T. Radiotherapy and the survival of dental implants: a systematic review[J]. Br J Oral Maxillofac Surg, 2022, 60(4): 422-429. doi: 10.1016/j.bjoms.2021.09.006.

[19] Fickl S, Zuhr O, Wachtel H, et al. Tissue alterations after tooth extraction with and without surgical trauma: a volumetric study in the beagle dog[J]. J Clin Periodontol, 2008, 35(4): 356-363. doi: 10.1111/j.1600-051X.2008.01209.x.

[20] Tavelli L, Heck T, De Souza AB, et al. Implant esthetic complications: anatomical, prosthetic, and patient-centered considerations for treatment[J]. Int J Periodontics Restorative Dent, 2023, 43(3): 281-288. doi: 10.11607/prd.6538.

[21] Belser U, Buser D, Higginbottom F. Consensus statements and recommended clinical procedures regarding esthetics in implant dentistry[J]. Int J Oral Maxillofac Implants, 2004, 19 Suppl: 73-74.

[22] Ramanauskaite A, Sader R. Esthetic complications in implant dentistry[J]. Periodontol 2000, 2022, 88(1): 73-85. doi: 10.1111/prd.12412.

[23] Renouard F, Amalberti R, Renouard E. Are "human factors" the primary cause of complications in the field of implant dentistry? [J]. Int J Oral Maxillofac Implants, 2017, 32(2): e55-e61. doi: 10.11607/jomi.2017.2.e.

[24] Campelo LD, Camara JR. Flapless implant surgery: a 10-year clinical retrospective analysis[J]. Int J Oral Maxillofac Implants, 2002, 17(2): 271-276.

[25] Bover-Ramos F, Viña-Almunia J, Cervera-Ballester J, et al. Accuracy of implant placement with computer-guided surgery: a systematic review and meta-analysis comparing cadaver, clinical, and *in vitro* studies[J]. Int J Oral Maxillofac Implants, 2018, 33(1): 101–115. doi: 10.11607/jomi.5556.

[26] Khaohoen A, Powcharoen W, Sornsuwan T, et al. Accuracy of implant placement with computer-aided static, dynamic, and robot-assisted surgery: a systematic review and meta-analysis of clinical trials[J]. BMC Oral Health, 2024, 24(1): 359. doi: 10.1186/s12903-024-04033-y.

[27] Luongo F, Lerner H, Gesso C, et al. Accuracy in static guided implant surgery: results from a multicenter retrospective clinical study on 21 patients treated in three private practices[J]. J Dent, 2024, 140: 104795. doi: 10.1016/j.jdent.2023.104795.

[28] Pellegrino G, Ferri A, Del Fabbro M, et al. Dynamic navigation in implant dentistry: a systematic review and meta-analysis[J]. Int J Oral Maxillofac Implants, 2021, 36(5): e121-e140. doi: 10.11607/jomi.8770.

[29] Jain S, Sayed ME, Ibraheem WI, et al. Accuracy comparison between robot-assisted dental implant placement and static/dynamic computer-assisted implant surgery: a systematic review and meta-analysis of *in vitro* studies[J]. Medicina(Kaunas), 2023, 60(1): 11. doi: 10.3390/medicina60010011.

[30] Magrin GL, Rafael SNF, Passoni BB, et al. Clinical and tomographic comparison of dental implants placed by guided virtual surgery versus conventional technique: a split-mouth randomized clinical trial[J]. J Clin Periodontol, 2020, 47(1): 120-128. doi: 10.1111/jcpe.13211.

[31] Frizzera F, Calazans NNN, Pascoal CH, et al. Flapless guided implant surgeries compared with conventional surgeries performed by nonexperienced individuals: randomized and controlled split-mouth clinical trial[J]. Int J Oral Maxillofac Implants, 2021, 36(4): 755-761. doi: 10.11607/jomi.8722.

[32] Bernard L, Vercruyssen M, Duyck J, et al. A randomized controlled clinical trial comparing guided with nonguided implant placement: a 3-year follow-up of implant-centered outcomes[J]. J Prosthet Dent, 2019, 121(6): 904-910. doi: 10.1016/j. prosdent.2018.09.004.

[33] Jafri Z, Ahmad N, Sawai M, et al. Digital smile design-an innovative tool in aesthetic dentistry[J]. J Oral Biol Craniofac Res, 2020, 10(2): 194-198. doi: 10.1016/j.jobcr.2020.04.010.

[34] Schwendicke F, Samek W, Krois J. Artificial intelligence in dentistry: chances and challenges[J]. J Dent Res, 2020, 99(7): 769 - 774. doi: 10.1177/0022034520915714.

[35] Zhou W, Liu Z, Song L, et al. Clinical factors affecting the accuracy of guided implant surgery—a systematic review and meta-analysis[J]. J Evid Based Dent Pract, 2018, 18(1): 28-40. doi: 10.1016/j.jebdp.2017.07.007.

[36] Monje A, Roccuzzo A, Buser D, et al. Influence of buccal bone wall thickness on the peri-implant hard and soft tissue dimensional changes: a systematic review[J]. Clin Oral Implants Res, 2023, 34 Suppl 26: 8-27. doi: 10.1111/clr.14177.

[37] Levine RA, Huynh-Ba G, Cochran DL. Soft tissue augmentation procedures for mucogingival defects in esthetic sites[J]. Int J Oral Maxillofac Implants, 2014, 29 Suppl: 155-185. doi: 10.11607/jomi.2014suppl.g3.2.

[38] Araújo MG, Linder E, Lindhe J. Bio-Oss collagen in the buccal gap at immediate implants: a 6-month study in the dog[J]. Clin Oral Implants Res, 2011, 22(1): 1-8. doi: 10.1111/j. 1600-0501.2010.01920.x.

[39] Shemtov-Yona K, Rittel D, Machtei EE, et al. Effect of dental implant diameter on fatigue performance. Part II: failure analysis[J]. Clin Implant Dent Relat Res, 2014, 16(2): 178-184. doi: 10.1111/j.1708-8208.2012.00476.x.

[40] Chrcanovic BR, Albrektsson T, Wennerberg A. Platform switch and dental implants: a meta-analysis[J]. J Dent, 2015, 43(6): 629-646. doi: 10.1016/j.jdent.2014.12.013.

[41] Hämmerle CH, Brägger U, Bürgin W, et al. The effect of subcrestal placement of the polished surface of ITI implants on marginal soft and hard tissues[J]. Clin Oral Implants Res, 1996, 7(2): 111-119. doi: 10.1034/j.1600-0501.1996.070204.x.

[42] Shin YK, Han CH, Heo SJ, et al. Radiographic evaluation of marginal bone level around implants with different neck designs after 1 year[J]. Int J Oral Maxillofac Implants, 2006, 21(5): 789-794.

[43] Hänggi MP, Hänggi DC, Schoolfield JD, et al. Crestal bone changes around titanium implants. Part I: a retrospective radiographic evaluation in humans comparing two non-submerged implant designs with different machined collar lengths[J]. J Periodontol, 2005, 76(5): 791-802. doi: 10.1902/jop.2005.76.5.791.

[44] Peñarrocha-Diago MA, Flichy-Fernández AJ, Alonso-González R, et al. Influence of implant neck design and implant-abutment connection type on peri-implant health. Radiological study[J]. Clin Oral Implants Res, 2013, 24(11): 1192-1200. doi: 10.1111/j.1600-0501.2012.02562.x.

[45] Lekholm U, Adell R, Lindhe J, et al. Marginal tissue reactions at osseointegrated titanium fixtures. (II) A cross-sectional retrospective study[J]. Int J Oral Maxillofac Surg, 1986, 15(1): 53-61. doi: 10.1016/s0300-9785(86)80011-4.

[46] Berglundh T, Gotfredsen K, Zitzmann NU, et al. Spontaneous progression of ligature induced peri-implantitis at implants with different surface roughness: an experimental study in dogs[J]. Clin Oral Implants Res, 2007, 18(5): 655-661. doi: 10.1111/j. 1600-0501.2007.01397.x.

[47] Lang NP, Berglundh T. Periimplant diseases: where are we now? - Consensus of the seventh European workshop on periodontology [J]. J Clin Periodontol, 2011, 38(Suppl 11): 178-181. doi: 10.1111/j.1600-051X.2010.01674.x.

[48] Freitas-Júnior AC, Rocha EP, Bonfante EA, et al. Biomechanical evaluation of internal and external hexagon platform switched implant-abutment connections: an *in vitro* laboratory and three-dimensional finite element analysis[J]. Dent Mater, 2012, 28(10): e218-28. doi: 10.1016/j.dental.2012.05.004.

[49] Hermann JS, Schoolfield 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]. J Periodontol, 2001, 72(10): 1372-1383. doi: 10.1902/jop.2001.72.10.1372.

[50] King GN, Hermann JS, Schoolfield JD, et al. Influence of the size of the microgap on crestal bone levels in non-submerged dental implants: a radiographic study in the canine mandible[J]. J Periodontol, 2002, 73(10): 1111-1117. doi: 10.1902/jop.2002.73.10.1111.

[51] Zipprich H, Miatke S, Hmaidouch R, et al. A new experimental design for bacterial microleakage investigation at the implant-abutment interface: an *in vitro* study[J]. Int J Oral Maxillofac Implants, 2016, 31(1): 37-44. doi: 10.11607/jomi.3713.

[52] Michalakis KX, Calvani PL, Muftu S, et al. The effect of different implant-abutment connections on screw joint stability[J]. J Oral Implantol, 2014, 40(2): 146-152. doi: 10.1563/AAID-JOI-D-11-00032.

[53] Bosshardt DD, Chappuis V, Buser D. Osseointegration of titanium, titanium alloy and zirconia dental implants: current knowledge and open questions[J]. Periodontol 2000, 2017, 73(1): 22-40. doi: 10.1111/prd.12179.

[54] Kunrath MF ,Garaicoa-Pazmino C,Giraldo-Osorno PM,et al.Implant surface modifications and their impact on osseointegration and peri-implant diseases through epigenetic changes: a scoping review[J].J Periodontol Res, 2024, 59(6): 1095-1114 .doi:10.1111/jre.13273.

[55] Chappuis V, Engel O, Shahim K, et al. Soft tissue alterations in esthetic postextraction sites: a 3-dimensional analysis[J]. J Dent Res, 2015, 94(9 Suppl): 187S-193S. doi: 10.1177/0022034515592869.

[56] Hürzeler MB, Zuhr O, Schupbach P, et al. The socket-shield technique: a proof-of-principle report[J]. J Clin Periodontol, 2010, 37 (9): 855-862. doi: 10.1111/j.1600-051X.2010.01595.x.

[57] 朱一博, 邱立新, 陈硌, 等. 上前牙区牙片屏障即刻种植术临床效果的初步研究[J]. 中华口腔医学杂志, 2018, 53(10): 665-668. doi: 10.3760/cma.j.issn.1002-0098.2018.10.004.
Zhu YB, Qiu LX, Chen L, et al. Clinical evaluation of socket shield technique in maxillary anterior region[J]. Chin J Stomatol, 2018, 53(10): 665-668. doi: 10.3760/cma.j.issn.1002-0098.2018.10.004.

[58] Lang NP, Tonetti MS, Suvan JE, et al. Immediate implant placement with transmucosal healing in areas of aesthetic priority. A multicentre randomized-controlled clinical trial I. Surgical outcomes[J]. Clin Oral Implants Res, 2007, 18(2): 188-196. doi: 10.1111/j.1600-0501.2006.01371.x.

[59] Seyssens L, De Lat L, Cosyn J. Immediate implant placement with or without connective tissue graft: a systematic review and meta-analysis[J]. J clin periodontol, 2021, 48(2): 284-301. doi: 10.1111/jcpe.13397.

[60] Thoma DS, Naenni N, Figuero E, et al. Effects of soft tissue augmentation procedures on peri-implant health or disease: a systematic review and meta-analysis[J]. Clin Oral Implants Res, 2018, 29 Suppl 15: 32-49. doi: 10.1111/clr.13114.

[61] Kan JY, Rungcharassaeng K, Lozada JL, et al. Facial gingival tissue stability following immediate placement and provisionalization of maxillary anterior single implants: a 2- to 8-year follow-up[J]. Int J Oral Maxillofac Implants, 2011, 26(1): 179-187.

[62] Linkevicius T, Puisys A, Linkeviciene L, et al. Crestal bone stability around implants with horizontally matching connection after soft tissue thickening: a prospective clinical trial[J]. Clin Implant Dent Relat Res, 2015, 17(3): 497-508. doi: 10.1111/cid.12155.

[63] Stefanini M, Rendón A, Zucchelli A, et al. Avoiding errors and complications related to immediate implant placement in the esthetic area with a mucogingival approach[J]. Periodontol 2000, 2023, 92(1): 362-372. doi: 10.1111/prd.12491.

[64] Zucchelli G, Felice P, Mazzotti C, et al. 5-year outcomes after coverage of soft tissue dehiscence around single implants: a prospective cohort study[J]. Eur J Oral Implantol, 2018, 11(2): 215-224.

[65] Zucchelli G, Mazzotti C, Mounssif I, et al. A novel surgical-prosthetic approach for soft tissue dehiscence coverage around single implant[J]. Clin Oral Implants Res, 2013, 24(9): 957-962. doi: 10.1111/clr.12003.

[66] Grunder U, Gracis S, Capelli M. Influence of the 3-D bone-to-implant relationship on esthetics[J]. Int J Periodontics Restorative Dent, 2005, 25(2): 113-119.

[67] Schoenbaum TR. Abutment emergence profile and its effect on peri-implant tissues[J]. Compend Contin Educ Dent, 2015, 36(7): 474-479.

[68] Katafuchi M, Weinstein BF, Leroux BG, et al. Restoration contour is a risk indicator for peri-implantitis: a cross-sectional radiographic analysis[J]. J Clin Periodontol, 2018, 45(2): 225-232. doi: 10.1111/jcpe.12829.

[69] 王鹃, 尉华杰, 邱立新. 前牙种植修复体穿龈形态设计的研究进展[J]. 中华口腔医学杂志, 2020, 55(6): 417-420. doi: 10.3760/cma.j.cn112144-20190729-00292.
Wang J, Yu HJ, Qiu LX. Progress in emergence profile design for implant restorations in the esthetic area[J]. Chin J Stomatol, 2020, 55(6): 417-420. doi: 10.3760/cma.j.cn112144-20190729-00292.

[70] Vargas SM, Dimalanta WG, Johnson TM. Guided protocol for indirect fabrication of a custom provisional restoration prior to immediate implant surgery in the esthetic zone[J]. Clin Adv Periodontics, 2023, 13(4): 217-226. doi: 10.1002/cap.10215.

[71] Degidi M, Nardi D, Piattelli A. One abutment at one time: non-removal of an immediate abutment and its effect on bone healing around subcrestal tapered implants[J]. Clin Oral Implants Res, 2011, 22(11): 1303-1307. doi: 10.1111/j.1600-0501.2010.02111.x.

[72] Herrera D, Berglundh T, Schwarz F, et al. Prevention and treatment of peri-implant diseases - the EFP S3 level clinical practice guideline[J]. J Clin Periodontol, 2023, 50 Suppl 26: 4-76. doi: 10.1111/jcpe.13823.

[73] Wade WG. The oral microbiome in health and disease[J]. Pharmacol Res, 2013, 69(1): 137-143. doi: 10.1016/j.phrs.2012.11.006.

[74] Rakic M, Grusovin M, Canullo L. The microbiologic profile associated with peri-implantitis in humans: a systematic review[J]. Int J Oral Maxillofac Implants, 2016, 31(2): 359-368. doi: 10.11607/jomi.4150.

[75] Heitz-Mayfield LJ. Peri-implant diseases: diagnosis and risk indicators. [J]. J Clin Periodontol, 2008, 35(8 Suppl): 292-304. doi: 10.1111/j.1600-051X.2008.01275.x.

[76] van Velzen FJJ, Lang NP, Schulten EA, et al. Dental floss as a possible risk for the development of peri-implant disease: an observational study of 10 cases[J]. Clin Oral Implants Res, 2016, 27(5): 618-621. doi: 10.1111/clr.12650.

[77] Dalago HR, Schuldt Filho G, Rodrigues MA, et al. Risk indicators for peri-implantitis. A cross-sectional study with 916 implants[J]. Clin Oral Implant Res, 2017, 28(2): 144 – 150. doj: 10.1111/clr.12772.

[78] Lemos CA, de Souza Batista VE, Almeida DA, et al. Evaluation of cement-retained versus screw-retained implant-supported restorations for marginal bone loss: a systematic review and meta-analysis [J]. J Prosthet Dent, 2016, 115(4): 419-427. doi: 10.1016/j.prosdent.2015.08.026.

[79] Stiesch M, Grischke J, Schaefer P, et al. Supportive care for the prevention of disease recurrence/progression following peri-implantitis treatment: a systematic review[J]. J Clin Periodontol, 2023, 50(Suppl 26): 113-134. doi: 10.1111/jcpe.13822.

[80] Costa FO, Takenaka-Martinez S, Cota LO, et al. Peri-implant disease in subjects with and without preventive maintenance: a 5-year follow-up[J]. J Clin Periodontol, 2012, 39(2): 173-181. doi: 10.1111/j.1600-051X.2011.01819.x.

[81] Renvert S, Persson GR, Pirih FQ, et al. Peri-implant health, peri-implant mucositis, and peri-implantitis: case definitions and diagnostic considerations[J]. J Periodontol, 2018, 89(Suppl 1): S304-S312. doi: 10.1002/JPER.17-0588.

[82] Karlsson K, Derks J, Håkansson J, et al. Interventions for peri-implantitis and their effects on further bone loss: a retrospective analysis of a registry-based cohort[J]. J Clin Periodontol, 2019, 46 (8): 872-879. doi: 10.1111/jcpe.13129.

[83] Karlsson K, Trullenque-Eriksson A, Tomasi C, et al. Efficacy of access flap and pocket elimination procedures in the management of peri-implantitis: a systematic review and meta-analysis[J]. J Clin Periodontol, 2023, 50(Suppl 26): 244-284. doi: 10.1111/jcpe.13732.

[84] Donos N, Calciolari E, Ghuman M, et al. The efficacy of bone reconstructive therapies in the management of peri-implantitis. A systematic review and meta-analysis[J]. J Clin Periodontol, 2023, 50 Suppl 26: 285-316. doi: 10.1111/jcpe.13775.

[85] Kan JY, Rungcharassaeng K, Lozada JL, et al. Effects of smoking on implant success in grafted maxillary sinuses[J]. J Prosthet Dent, 1999, 82(3): 307-311. doi: 10.1016/s0022-3913(99)70085-5.

[86] Naujokat H, Kunzendorf B, Wiltfang J. Dental implants and diabetes mellitus-a systematic review[J]. Int J Implant Dent, 2016, 2(1): 5. doi: 10.1186/s40729-016-0038-2.

[87] Forsberg CM, Eliasson S, Westergren H. Face height and tooth eruption in adults - a 20-year follow-up investigation[J]. Eur J Orthod, 1991, 13(4): 249-254. doi: 10.1093/ejo/13.4.249.

[88] Aarts BE, Convens J, Bronkhorst EM, et al. Cessation of facial growth in subjects with short, average, and long facial types - implications for the timing of implant placement[J]. J Craniomaxillofac Surg, 2015, 43(10): 2106-2111. doi: 10.1016/j.jcms.2015.10.013.

[89] Chiappelli F. Evidence-based dentistry: two decades and beyond [J]. J Evid Based Dent Pract, 2019, 19(1): 7-16. doi: 10.1016/j.jebdp.2018.05.001.

[90] Lohr KN. Rating the strength of scientific evidence: relevance for quality improvement programs[J]. Int J Qual Health Care , 2004, 16(1): 9-18. doi: 10.1093/intqhc/mzh005.

[91] Tonetti M, Sanz M, Cairo F, et al. Aesthetics and patient-reported outcomes in periodontology and implant dentistry: consensus report[J]. J Clin Periodontol, 2025. doi: 10.1111/jcpe.14182.

[92] Tonetti MS, Jung RE, Avila-Ortiz G, et al. Management of the extraction socket and timing of implant placement: consensus report and clinical recommendations of group 3 of the XV European workshop in periodontology[J]. J Clin Periodontol, 2019, 46(Suppl 21): 183-194. doi: 10.1111/jcpe.13131.

[93] Cosyn J, De Lat L, Seyssens L, et al. The effectiveness of immediate implant placement for single tooth replacement compared to delayed implant placement: a systematic review and meta-analysis [J]. J Clin Periodontol, 2019, 46(Suppl 21): 224-241. doi: 10.1111/jcpe.13054.

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【通信作者简介】 邱立新，主任医师，北京市口腔种植专业委员会主任委员，中华口腔医学会口腔种植专业委员会副主任委员。1988年毕业于北京大学口腔医学院，1994年在北京大学口腔医学院种植中心开始从事口腔种植专业工作，1999年到奥地利维也纳大学牙科学院种植外科进修学习，其后又多次赴欧洲参观学习。20多年来一直工作在临床的第一线，种植病例超万例，积累了丰富临床经验，把握口腔种植发展的最新方向。专业特长为口腔种植外科、骨量不足情况下多种植骨技术的应用、复杂病例的软硬组织美学重建与美学修复。在国内率先开展多项种植外科新技术（引导骨再生技术、水压法上颌窦底内提升技术、拔牙窝植骨位点保存技术、皮质骨片三维软硬组织重建技术、结缔组织及角化黏膜游离移植技术、牙片保留技术等）。

【作者简介】 李熠，北京大学口腔医院第四门诊部牙周科主任，副主任医师，博士，中华口腔医学会激光专业委员会青年委员。从事牙周专科治疗及口腔种植治疗，擅长复杂牙周病的系统治疗、牙周再生治疗、牙周正畸联合治疗及牙周炎患者种植治疗。主要临床研究方向为牙周种植软硬组织再生技术。主持北京大学口腔医院新技术新疗法项目两项，在国内外学术杂志发表论文和翻译文章20余篇。