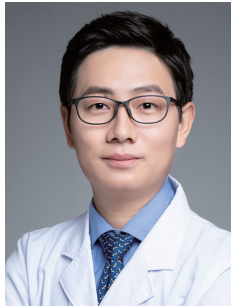


# 经前庭沟切口的骨膜下隧道技术在牙龈退缩治疗中的应用

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**【摘要】** 牙龈退缩作为常见口腔病损, 可影响患者牙齿美观和引起功能障碍。临床上有多种治疗牙龈退缩的膜龈手术, 近年来一种新的微创术式——经前庭沟切口的骨膜下隧道技术(VISTA)因其根面覆盖率高、术后美学效果好等优点得到日益广泛的应用。临床研究表明, VISTA技术的应用可以使牙龈退缩深度和宽度减少, 角化龈增加, 且患者术后反应较轻, 美学评分较高。本文介绍了VISTA技术的演变史、优势、适应证、手术步骤和相关临床疗效评估, 以期促进VISTA技术在牙龈退缩治疗中的应用。

**【关键词】** 经前庭沟切口的骨膜下隧道技术; 牙龈退缩; 微创; 根面覆盖

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## Application of vestibular incision subperiosteal tunnel access in the treatment of gingival recession

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**【Abstract】** Gingival recession, a prevalent oral condition, poses both aesthetic and functional challenges for the affected teeth. Various mucogingival surgical approaches

have been developed to address gingival recession. In recent years, the vestibular incision subperiosteal tunnel access (VISTA) technique has gained prominence due to its minimally invasive nature and its capacity to achieve substantial root coverage and superior aesthetic outcomes. Numerous clinical investigations have demonstrated the efficacy of VISTA in reducing recession depth and width, augmenting keratinized gingival width, and minimizing postoperative complications while enhancing aesthetic outcomes. This article aimed to comprehensively review the evolution of VISTA, elucidate its advantages and indications, delineate surgical procedures, and evaluate its clinical efficacy, with the overarching goal of fostering wider adoption of this technique in gingival recession treatment.

**【Key words】** Vestibular incision subperiosteal tunnel access; Gingival recession; Minimally invasive; Root surface coverage

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牙龈退缩是由于菌斑、机械创伤和解剖等因素引起的牙龈边缘向釉牙骨质界(cemento-enamel junction, CEJ)根方移位, 导致根面暴露的发生。牙龈退缩在人群中患病率较高, 并且可伴发一系列并发症, 如美观问题、牙本质敏感、食物嵌塞及根面龋发生率升高等<sup>[1-2]</sup>。因此, 如何治疗牙龈退缩达到良好的根面覆盖效果, 进而恢复健康的牙周组织结构, 是口腔医师们面临的一项挑战。目前, 临床上已发展出多种治疗牙龈退缩的膜龈手术, 随着人们对美

学和微创手术需求的增加,一种新的膜龈手术——经前庭沟切口的骨膜下隧道技术(vestibular incision subperiosteal tunnel access, VISTA)得到了日益广泛的应用。本文将针对VISTA技术在牙龈退缩治疗中的应用进行阐述和讨论。

### 一、经前庭沟切口的骨膜下隧道技术的演变

临床上常用于牙龈退缩治疗的膜龈手术包括游离龈移植术、侧向转位瓣术、冠向复位瓣术(coronally advanced flap, CAF)和结缔组织移植术(connective tissue graft, CTG)等。多项系统综述对比了不同膜龈手术的临床效果,发现CAF+CTG是治疗单牙和连续多牙牙龈退缩最有效的术式,平均根面覆盖率(mean root coverage, MRC)达到68.8%~99.3%,完全根面覆盖率(complete root coverage, CRC)达到46.8%~95.6%,该术式被认为是目前治疗牙龈退缩的金标准<sup>[3-7]</sup>。但是,CAF需在患牙两侧做延伸至膜龈联合根方的垂直切口,手术创面较大。因此,学者们一直致力于发展更微创的术式来治疗牙龈退缩。1994年,Allen<sup>[8]</sup>提出了“隧道技术”(tunnel technique, TUN),即保留牙间龈乳头,沿着患牙龈缘做沟内切口并向根方潜行分离龈瓣至膜龈联合,制备出1个贯通术区患牙牙龈下方的“隧道”,随后牵引结缔组织移植物进入隧道并缝合固定,以实现患牙的根面覆盖。TUN技术不仅保留了龈乳头,使移植部位的血供得到了较为充足的保障,而且隐蔽的切口设计减少了术后瘢痕组织的出现,有利于获得更好的美观效果<sup>[9]</sup>。Allen<sup>[8]</sup>最初提出TUN技术时没有对分离的隧道瓣进行冠向复位,难以覆盖结缔组织移植物和暴露的根面。Zuhr等<sup>[10]</sup>对该技术进行了改进,将隧道瓣进行冠向复位来完全覆盖移植物和牙根面,从而促进移植物成活及龈缘形态恢复,因此也被称为改良冠向复位隧道技术(modified coronally advanced tunnel, MCAT)。但是,该技术仍存在一些局限性,如操作难度较大,隧道瓣穿孔和撕裂的风险较高,以及空间较小容纳移植物有限等。为了改善手术入路,更好地实现龈瓣减张,Zadeh<sup>[11]</sup>2011年提出了VISTA术式,该术式以上唇系带为入路做垂直切口,通过该切口制备1个骨膜下隧道通路,牵引结缔组织移植物进入隧道,最后冠向复位龈瓣并用树脂将牵拉缝线固定于牙面上。2015年, Lee等<sup>[12]</sup>提出了改良前庭沟切口的骨膜下隧道技术(modified vestibular incision subperiosteal tunnel access, M-VISTA),即在邻近牙龈退缩患牙的前庭沟区域做垂直切口,不再局

限于系带入路切口,以方便隧道制备和移植物置入。

### 二、经前庭沟切口的骨膜下隧道技术的优势及适应证

VISTA技术与TUN技术一样保留了完整的龈乳头附着,维持了受区的血供以促进移植物成活,较CAF减少了术区组织的损伤。与TUN技术相比,VISTA技术的切口更为简便,通过前庭沟垂直切口即可制备出骨膜下隧道,同时增加了隧道的空间,提高了龈瓣的活动性,便于容纳结缔组织移植物和龈瓣冠向复位,易于初学者掌握<sup>[13-16]</sup>。部分学者认为,VISTA技术未行龈沟内切口,减少了龈缘血供破坏及术中分离龈瓣时反复牵拉造成的损伤<sup>[15-17]</sup>。此外,VISTA技术利用流动树脂将缝线粘接在牙冠表面,这为龈瓣的冠向复位及固定提供了持续而稳定的力量,有利于防止龈瓣的细微移位,增加冠向复位的稳定性和提高冠向复位的程度,获得长期稳定的美学效果,术后粉色美学评分(pink esthetic score, PES)达到7.41~9.10<sup>[18]</sup>。VISTA技术同样存在一些不足,部分学者认为VISTA技术相较于TUN技术增加了垂直切口,可能影响术区局部血供并导致术后疼痛增加<sup>[11,19-20]</sup>;当选择唇颊系带以外的前庭沟区域做垂直切口时,可能形成瘢痕影响美观<sup>[19-20]</sup>;采用流动树脂将缝线粘接于患牙唇面可导致愈合阶段异物感较明显,增加术后不适。

由于VISTA技术术式合理,受牙龈厚度及牙位分布的限制较小,其在牙龈退缩治疗中的适应证较广泛<sup>[13]</sup>。多项临床研究提示,VISTA技术可用于单牙和连续多牙Miller I、II、III类牙龈退缩的治疗<sup>[15,17,21-24]</sup>。VISTA技术还可用于种植体周围的软组织增量,避免术后植体暴露,维持种植体周围牙周组织健康<sup>[12,25-26]</sup>。VISTA技术禁忌证主要包括因全身疾病不能行牙周手术者,Miller IV类牙龈退缩,以及前庭沟过浅导致冠向复位空间不足等<sup>[11,15,27]</sup>。

### 三、经前庭沟切口的骨膜下隧道技术操作步骤

1. 根面处理:术前通过龈下刮治和根面平整术去除患牙根面菌斑牙石等感染物质,同时降低牙根凸度减少缝合张力,以利于组织瓣成活<sup>[23,28]</sup>。还可考虑配合化学处理如枸橼酸、24%乙二胺四乙酸等试剂涂布牙根表面以去除残余玷污层,使表面脱矿暴露胶原纤维,促进参与牙周组织愈合的细胞在此处黏附增殖<sup>[29]</sup>。目前,尚无明确证据表明化学处理可以提高根面覆盖术的临床效果。

2. 制备垂直切口及骨膜下隧道:对术区进行局

部麻醉后,在系带或患牙膜龈联合附近向根尖方向做1个小范围前庭沟垂直切口,以该切口为入路用隧道刀将软组织与骨面潜行分离,翻起黏骨膜瓣形成隧道,分离范围为冠方达术区患牙龈乳头,根方超过膜龈联合,手术中应注意在不撕裂龈乳头的前提下尽可能分离龈瓣增大手术空间,使龈瓣活动性增加,能充分松弛并冠向复位到CEJ冠方至少2 mm处<sup>[22,30]</sup>。若VISTA的垂直切口累及唇颊系带,则必须彻底离断系带下方的肌肉纤维附着,避免愈合过程中唇颊部牵拉移动影响组织稳定性<sup>[14]</sup>。

根据患牙牙位不同,术者可以灵活选择不同的垂直切口位置。单牙牙龈退缩行VISTA治疗时,多在患牙近中或远中的膜龈联合处作切口;连续多牙牙龈退缩行VISTA治疗时,垂直切口常选择术区中线位置;当牙龈退缩累及3个以上牙位时,单一垂直切口的入路有限,可增加多个垂直切口<sup>[13,15,24]</sup>。由于垂直切口术后愈合易形成瘢痕,美学区多以唇系带或邻近的颊系带为入路做切口,以减少瘢痕带来的美观问题<sup>[11,15,19]</sup>。

3. CTG的获取:患牙软组织厚度是预测根面覆盖手术疗效和牙龈组织稳定性的关键参数<sup>[18,31]</sup>。VISTA技术本身仅牵拉龈瓣冠向复位覆盖暴露的根面,并不能使术区牙龈厚度增加,因此常需和CTG联合应用以获得更好的临床效果。一般多以上颌前磨牙至磨牙区腭侧作为供区,取厚约1~2 mm的上皮下结缔组织,用缝线牵引其通过垂直切口进入隧道,覆盖患牙根面并固定<sup>[32]</sup>。目前,诸多学者致力于研究使用生物材料如富血小板纤维蛋白(platelet rich fibrin, PRF)<sup>[32-34]</sup>、猪胶原蛋白基质(volume-stable porcine collagen matrix, VCMX)<sup>[22]</sup>和人体来源的脱细胞真皮基质(acellular dermal collagen matrix, ADM)<sup>[35-36]</sup>等来代替传统的CTG移植,避免选择自体口内供区,从而减轻患者心理负担和术后反应。

4. 缝合:VISTA技术的缝合包括龈瓣的缝合、CTG的缝合和垂直切口的缝合。其中龈瓣的缝合多从距龈缘约1~2 mm进针,然后牵引龈瓣至CEJ冠方并用流动树脂将缝线粘接于患牙唇面协助固位;CTG的固定多用距龈缘约2~3 mm进针的悬吊缝合法,必要时可增加间断缝合;前庭沟切口多做间断缝合<sup>[13,22,37]</sup>。VISTA操作步骤如图1所示。

四、经前庭沟切口的骨膜下隧道技术临床疗效评估

1. 临床指标评价:VISTA技术在牙龈退缩治疗

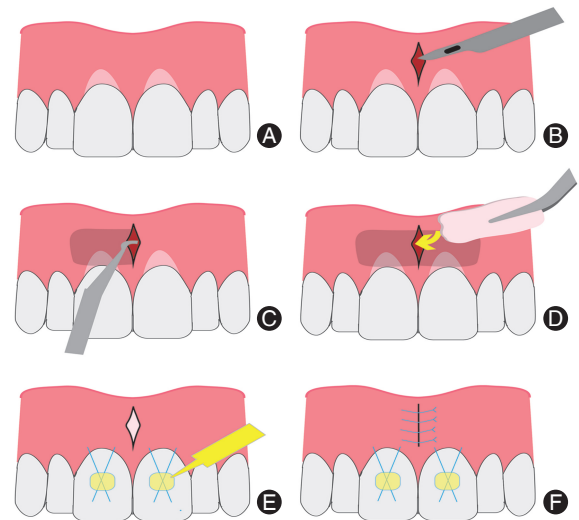


图1 经前庭沟切口的骨膜下隧道技术(VISTA)操作示意图 A:#11、#21牙龈退缩;B:唇系带处做垂直切口;C:制备骨膜下隧道;D:置入结缔组织移植体(CTG);E:缝线牵引龈瓣冠向复位,流动树脂粘接缝线于患牙唇面固位;F:缝合垂直切口。

中的临床效果明确。范可昂等<sup>[13]</sup>用VISTA技术治疗单牙牙龈退缩时,MRC达到 $(86.67 \pm 21.94)\%$ 、CRC达到70%。Sabri等<sup>[17]</sup>对VISTA技术进行Meta分析发现,用于治疗连续多牙的牙龈退缩时,MRC达到 $(88.15 \pm 20.79)\%$ 、CRC达到 $(67.85 \pm 21.72)\%$ ,同时可显著减小牙龈退缩深度(gingival recession depth, GRD)、探诊深度(probing depth, PD)和临床附着丧失(clinical attachment level, CAL),并增加术区角化龈宽度(keratinized gingiva width, KGW)。

本课题组总结了现有关于VISTA技术与其他膜龈手术临床疗效对比的研究,如表1所示。其中,4项研究对比了VISTA技术与TUN技术的临床效果,孙文韬等<sup>[14]</sup>的研究提示,TUN组在术后计算根面覆盖率、CRC、GRD和KGW方面均优于VISTA组;而另外3项研究提示在术后CRC方面VISTA组优于TUN组<sup>[21,38]</sup>,在术后MRC方面差异无统计学意义<sup>[21,39]</sup>。对比VISTA技术和CAF的临床研究结果同样存在差异:在术后CRC方面,Mansouri等<sup>[16]</sup>发现VISTA组(50%)明显高于CAF组(33%);在术后MRC方面,Mansouri等<sup>[16]</sup>和Rajeswari等<sup>[40]</sup>的研究提示差异无统计学意义,而Dandu等<sup>[41]</sup>的研究发现VISTA组术后MRC $(87.37 \pm 17.78)\%$ 明显高于CAF组 $(71.84 \pm 19.25)\%$ ,且VISTA组的GRD、KGW和CAL变化显著。上述差异可能与研究者在术中使用移植体材料不同有关。对于VISTA技术在不同牙龈退缩类型中疗效对比,Cao等<sup>[15]</sup>发现Miller III类患牙术后

表1 经前庭沟切口的骨膜下隧道技术(VISTA)与“隧道技术”(TUN)、冠向复位瓣术(CAF)术后随访的临床指标比较( $\bar{x}\pm s$ )

作者	发表年份	类型	治疗方案	MRC (%)	CRC (%)	KGW (mm)	GRD (mm)	PD (mm)	CAL (mm)
Dandu等 <sup>[41]</sup>	2016年	Miller I、II	VISTA	87.37±17.78*	-	BL:2.75±0.91 9M:6.30±1.08*	BL:4.21±1.08 9M:0.61±0.92*	BL:0.46±0.37 9M:0.31±0.12	BL:4.67±0.99 9M:0.92±1.00*
			CAF	71.84±19.25	-	BL:2.63±1.24 9M:5.60±1.53	BL:4.17±1.18 9M:1.16±0.92	BL:0.45±0.29 9M:0.41±0.28	BL:4.57±1.32 9M:1.37±1.00
		Mansouri等 <sup>[16]</sup>	2019年	Miller I、II	VISTA (CTG)	70.69	50.00*	BL:1.49±2.66 6M:1.53±4.00	BL:1.33±2.83 6M:1.02±0.83
			CAF (CTG)	67.22	33.00	BL:2.63±3.25 6M:2.62±4.83	BL:1.20±3.00 6M:0.79±1.08	BL:0.28±1.08 6M:0.45±1.25	BL:1.34±4.00 6M:0.73±2.00
Mohamed等 <sup>[38]</sup>	2020年	Miller I、II	VISTA (ADM)	-	92.42±9.32*	BL:2.10±0.33 6M:3.38±0.37	BL:3.10±0.53 6M:0.25±0.29	BL:1.31±0.32 6M:0.98±0.10	BL:4.38±0.54 6M:1.23±0.26
			TUN (ADM)	-	82.50±12.89	BL:2.04±0.34 6M:3.33±0.46	BL:3.06±0.60 6M:0.56±0.43	BL:1.42±0.46 6M:1.06±0.37	BL:4.44±0.56 6M:1.63±0.42
		Rajeswari等 <sup>[40]</sup>	2021年	Miller I、II	VISTA (PRF)	93.95	-	BL:3.35±1.06 18M:3.67±0.97	BL:2.41±0.91 18M:0.15±0.27
			改良CAF (PRF)	96.84	-	BL:2.11±0.75 18M:2.56±0.71	BL:2.47±0.60 18M:0.08±0.23	BL:1.41±0.66 18M:1.19±0.48	BL:3.88±0.88 18M:1.26±0.57
Cao等 <sup>[15]</sup>	2021年	Miller I、II	VISTA (CTG)	99.00±5.00*	96.00*	BL:2.40±1.20 12M:2.86±1.03	BL:1.54±0.71 12M:0.02±0.10	BL:1.89±0.31 12M:1.93±0.28	BL:3.10±0.58 12M:1.82±0.43
			Miller III (CTG)	60.73±37.90	36.67	BL:2.22±0.85 12M:2.77±0.72	BL:1.50±1.01 12M:0.68±0.71	BL:1.84±0.26 12M:1.86±0.29	BL:3.23±1.14 12M:2.45±0.86
Geisinger等 <sup>[21]</sup>	2022年	Miller I、II	VISTA (ADM)	74.40	69.20*	BL:2.77±0.93 6M:3.00±0.82	BL:2.54±0.52 6M:0.40±0.20	BL:1.57±0.76 6M:1.22±0.14	-
			TUN (ADM)	75.20	56.30	BL:2.46±0.97 6M:2.60±0.52	BL:2.31±0.48 6M:0.47±0.15	BL:1.85±0.38 6M:1.60±0.22	-
Gameel等 <sup>[39]</sup>	2022年	Miller I、II	VISTA (CTG)	81.20±17.40	-	-	-	-	-
			TUN (CTG)	74.60±12.10	-	-	-	-	-
孙文韬等 <sup>[14]</sup>	2022年	Miller I、II	VISTA (CTG)	87.60±19.90*	70.10*	BL:2.27±1.62 6M:3.70±1.39*	BL:2.97±1.98 6M:0.65±1.18*	-	-
			TUN (CTG)	93.20±15.80	81.30	BL:2.39±1.56 6M:4.23±1.12	BL:3.19±1.61 6M:0.23±0.63	-	-

注:\*差异有统计学意义;CTG为结缔组织移植术;ADM为人体来源的脱细胞真皮基质;PRF为富血小板纤维蛋白;MRC为平均根面覆盖率;CRC为完全根面覆盖率;KGW为角化龈宽度;GRD为牙龈退缩深度;PD为探诊深度;CAL为临床附着丧失;BL为术前水平;6、9、12和18M分别为术后6、9、12和18个月后水平;“-”为无数据。

MRC和CRC分别为(60.73±37.90)%和36.67%,均显著低于Miller I类患牙[(99.00±5.00)%和96.00%],这可能与Miller III患牙自身牙周组织条件较差有关。孙文韬等<sup>[14]</sup>和Cao等<sup>[15]</sup>的研究均发现,上颌牙根面覆盖率优于下颌牙,可能与上颌龈乳头更加宽大,血供充足,且上颌前庭沟深度较下颌大,龈瓣更易冠向复位有关。

2. 美学评分及患者主观评价:除了临床指标的评价,针对患者的术后疼痛反馈和美学评估也十分必要。既往研究中常用视觉模拟评分法(visual analogue

scale, VAS)对患者疼痛程度(0分为无痛苦,10分为极其痛苦)进行评分;美学效果采用VAS(0分为不满意,10分为最满意)、PES或根面覆盖美学评分(root coverage esthetic score, RES)标准进行评估。

本课题组总结了关于VISTA术后患者的疼痛反馈和美学效果的相关研究(表2),发现患者疼痛评分为1.35~4.30,美学评分为7.41~9.10。而一项对比TUN技术与CAF的Meta分析显示,TUN技术术后美学评分为7.30~9.30,CAF术后美学评分为6.92~9.30<sup>[42]</sup>,提示VISTA技术与TUN及CAF的美学评分

表2 经前庭沟切口的骨膜下隧道技术(VISTA)术后随访的疼痛评分及美学评分比较

作者	发表年份	随访时间(个月)	类型	疼痛评分( $\bar{x} \pm s$ )	美学评分( $\bar{x} \pm s$ )
范可昂等 <sup>[13]</sup>	2019年	6	Miller I、II	4.30±2.95(VAS评分)	8.30±1.57(VAS评分)
Rajeswari等 <sup>[40]</sup>	2021年	18	Miller I、II	-	9.10±0.81(PES评分)
Fernández-Jiménez等 <sup>[43]</sup>	2021年	6	Miller III	1.35±1.29(VAS评分)	8.19±1.73(VAS评分)
Geisinger等 <sup>[21]</sup>	2022年	6	Miller I、II	2.14±0.49(VAS评分)	7.41±0.28(PES评分)
Gameel等 <sup>[39]</sup>	2022年	6	Miller I、II	-	7.80(RES评分)
孙文韬等 <sup>[14]</sup>	2022年	6	Miller I、II	-	8.25±2.02(RES评分)
Chen等 <sup>[19]</sup>	2023年	12	Miller I、II	-	8.61±1.45(RES评分)

注:VAS为视觉模拟评分法;PES为粉色美学评分法;RES为根面覆盖美学评分;“-”为无数据。

相近,可获得与二者相似的美学效果。孙文韬等<sup>[14]</sup>的研究对比了不同牙位VISTA技术与TUN技术的术后美学评分,提示在上颌前牙区和上颌后牙区VISTA组和TUN组无明显差异,下前牙区TUN组明显优于VISTA组。目前,仍缺乏对比VISTA技术、TUN技术和CAF术后疼痛的研究。

### 五、小结

VISTA技术为牙龈退缩提供了一种新的治疗选择,尤其在Miller I、II类牙龈退缩的治疗中效果明确(术后患牙根面覆盖率高、角化龈显著增加、疼痛感较轻和美学效果良好)。但是,现有关于VISTA技术的研究仍较少,样本量有限且随访时间较短。并且,鲜有研究关注VISTA技术在不同牙位和牙龈表型的患牙中的疗效差异,未来仍需进一步进行深入临床研究。另外,还可考虑加入其他术式进行随机对照临床试验,并利用口腔数字化扫描等手段建立更为客观的评价标准,从而更好地改进和推广该技术的临床应用,提高牙龈退缩的治疗效果。

**利益冲突** 所有作者均声明不存在利益冲突

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