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· 临床研究 ·

二硅酸锂基玻璃陶瓷单端树脂粘接桥修复个别前牙缺失的临床应用

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【摘要】 目的 探讨二硅酸锂基玻璃陶瓷单端树脂粘接桥修复个别前牙缺失的临床效果, 为个别前牙缺失修复方式的选择提供参考。方法 本研究已通过单位伦理委员会审查批准, 并获得患者知情同意。选取42例单颌前牙缺失数量在两颗内的患者, 采用二硅酸锂基玻璃陶瓷单端树脂粘接桥修复, 修复后6个月、1年、2年、3年进行随访, 评价美学、功能修复效果及牙周健康状况, 并采用视觉模拟评分量表(VAS)调查患者的满意度。结果 观察期间, 42例二硅酸锂基玻璃陶瓷单端树脂粘接桥修复的患者中有1例3个月内连接体发生断裂, 1例2年内发生脱粘; 美学修复效果的等级均评定为A级; 修复后牙周健康状况良好, 基牙及桥体下的软硬组织无临床吸收现象, 评价指标均为A级; 患者总满意率为100%。结论 对于个别前牙缺失, 二硅酸锂基玻璃陶瓷单端树脂粘接桥可达到微创、固位牢靠、美观舒适和生物相容性好的修复效果, 患者满意度高, 在临床中可以考虑作为一种理想的修复方式。

【关键词】 单端树脂粘接桥; 个别前牙缺失; 固定修复; 树脂粘接剂; 二硅酸锂基玻璃陶瓷; 氧化锆; 口腔美学; 微创; 患者满意度

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Clinical application of lithium disilicate glass ceramic cantilever resin-bonded fixed partial denture in the restoration of single anterior tooth loss CHANG Xingtao^{1,2}, HU Jiaxin^{1,2}, SHI Qianhui², SHAO Min³, SUN Jiangling⁴, BAI Guohui¹, LUO Yi^{1,2}.

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【Abstract】 Objective To investigate the clinical effect of lithium disilicate glass ceramic cantilever resin-bonded fixed partial dentures (CRBFPDs) on single anterior tooth loss to provide a reference for the selection of restoration methods for single anterior tooth loss. **Methods** This study was reviewed and approved by the Ethics Committee, and informed consent was obtained from the patients. Forty-two patients with less than two anterior teeth with monomaxillary loss were included in this study. After 6 months, 1 year, 2 years, and 3 years, the aesthetic and functional effects of the restorations and the periodontal health status were evaluated, and the visual analog scale (VAS) was used to assess patient satisfaction. **Results** During the observation period, the connector fractured in one case within 3 months. One case had debonded within 2 years. The aesthetic restoration effect of all lithium disilicate glass ceramic CRBFPDs was

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categorized as Class A. The periodontal health was good, there was no clinical absorption in the soft and hard tissues of the abutment or subbridge, periodontal status according to the evaluation indices was classified as class A, and the total satisfaction rate of the patient was 100%. **Conclusion** For single anterior tooth loss patients, lithium disilicate glass ceramic cantilever resin-bonded fixed partial denture can achieve the restoration effect of less invasion, better adhesion, aesthetics, comfort and good biocompatibility. With high patient satisfaction, it can be considered an ideal restoration method for replacing a single anterior tooth.

【Key words】 cantilever resin-bonded fixed partial denture; single anterior tooth loss; fixed prostheses; resin cements; lithium disilicate glass ceramics; zirconia; aesthetic dentistry; minimally invasive; patient satisfaction

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【Competing interest】 The authors declare no competing interests.

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个别前牙缺失是常见的一类牙列缺损,主要由牙根尖周疾病、先天发育不良、龋病和外伤等原因造成^[1],它影响着患者的咀嚼、发音和面部美观,影响患者心理健康。如今,人们对牙齿修复的要求不再局限于功能和美观,更期望在尽量减少牙体组织损伤的前提下获得更好的功能和美学改善。随着微创牙科学、材料学和粘接系统的发展,单端粘接桥可作为前牙缺失修复的较优选择,特别是受制于年龄解剖或经济条件的患者^[2]。单端树脂粘接桥又称悬臂式粘接桥(cantilever resin-bonded fixed partial denture, CRBFPD),是指仅磨除少量牙体组织,酸蚀后依靠树脂粘接剂将全冠粘接在缺牙相邻的一个基牙上的微创固定修复方式^[3],其具有备牙量保守、美观舒适、价格低廉、对牙周组织刺激小、脱落后可重新粘接等优势^[4-5]。本研究旨在探讨二硅酸锂基玻璃陶瓷单端树脂粘接桥在个别前牙缺失修复中的应用效果。

1 资料和方法

1.1 临床资料

本研究经贵阳市口腔医院伦理委员会审批通过(批准号:GYSKLL-20190307-06),患者均签署知情同意书。以2019-2020年期间于贵阳市口腔医院修复科就诊的42例患者为观察对象,年龄16~60岁,平均年龄(44.1±15.7)岁;男18例,女24例。缺失牙情况:单颗前牙缺失35例,两颗前牙缺失7例,其中,两颗前牙连续缺失占6例,牙位分布:上颌中切牙:1例;上颌侧切牙:6例;上颌尖牙:1例;下颌中切牙:36例;下颌侧切牙:5例,平均缺牙数:1.17。共完成二硅酸锂基玻璃陶瓷单端树脂粘接

桥49件。纳入标准:①口腔卫生良好,患者依从性高;②牙周条件良好或牙周炎经治疗后保持稳定,X射线显示牙槽骨吸收不超过根长1/3;③基牙牙体健康,无严重牙体缺损,满足粘接强度的健康釉质粘接面积至少有30 mm²,无异常松动,X射线显示根尖无阴影;④缺牙区有适当宽度恢复桥体大小,且有良好的软组织条件;⑤口内咬合基本正常。排除标准:①基牙严重倾斜扭转;②临床牙冠高度不足(<4 mm);③深覆殆、深覆盖、咬合紧、夜磨牙、下颌有不良功能运动者。

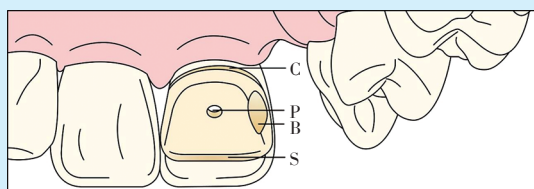
1.2 治疗过程

1.2.1 术前准备 修复前检查患者口内情况,行X射线辅助检查和完善系统性牙周治疗,取上下颌研究模型,并进行常规术前拍照。

1.2.2 比色、牙体预备及取模比色 自然光线下,Vita 3D-Master比色板(VITA公司,德国)进行比色,并联合数码影像获取美学信息。

牙体预备:遵循保存健康牙体组织的原则,牙体预备深度控制在釉质范围内^[6]。去除基牙邻面过大倒凹,基牙邻面釉质范围内制备一个小型箱状辅助固位型,约2 mm×2 mm×0.5 mm大小,切端浅肩台距离切缘2~3 mm,舌面预备一个深度0.5 mm,直径为1 mm的舌隆突钉洞,预备体浅凹形终止线控制在釉牙骨质界上方,设计在龈上0.5~1 mm,以右上颌侧切牙缺失为例的牙体预备设计原理见图1。硅橡胶(DMG,德国)印膜材二次法精确制取印膜,并取咬合记录。

1.2.3 内部结构的制作 灌制超硬石膏模型,送义齿加工中心完成修复体的制作(IPS e.max press, Ivoclar Vivadent,列支敦士登)。部分缺牙区牙龈萎



The design of retainers for cantilever resin-bonded fixed partial denture is mostly lingual or palatal wing plates. C: a light chamfer finish line was created 0.5-1 mm supragingivally. P: a pinhole with diameter of 1mm and depth of 0.5 mm. B: a proximal box(2 mm × 2 mm × 0.5 mm). S: a light shoulder was created 2-3 mm from the incisal edge

Figure 1 Schematic drawing of the palatal retaining wing preparation of right maxillary central incisor

图1 右上颌中切牙腭侧固位翼预备体设计原理图

缩的病例,桥体设计为改良盖嵴式。翼板应最少包绕轴面180°,横截面积至少8~10 mm²[7],翼板厚度至少1 mm[8]。

1.2.4 口内试戴 观察是否完全就位,边缘是否密合,形态、大小、颜色是否协调匹配,邻接是否合适,咬合接触及桥体与软组织接触情况是否良好,有必要时可酌情调改。

1.2.5 粘接 粘接前准备:①使用5%的氢氟酸液(Heraeus,德国)酸蚀修复体粘接面20 s,置入95%乙醇溶液中超声水浴荡洗3 min后干燥修复体。②硅烷偶联化(Ivoclar Vivadent,列支敦士登)处理1 min,热吹风轻吹1 min。③橡皮障隔湿术区,基牙粘接面打磨清洁后吹干。

粘接:37%磷酸(Heraeus,德国)酸蚀30 s,水雾冲洗15 s后彻底吹干,酸蚀成功的釉质表面呈无光泽的白垩色。修复体及牙体粘接面涂布通用型粘接剂(3M,美国),吹薄吹匀,光照10 s,最后选用Varolink N双固化树脂粘接剂(Ivoclar Vivadent,列

支敦士登)进行粘接,Superfloss清除多余粘接剂,在边缘注射阻氧剂(Ivoclar Vivadent,列支敦士登)并光照固化,冲洗干净多余的阻氧剂。彻底固化后检查并调整咬合,使其在静态咬合时,桥体与对颌牙轻接触;在动态咬合时,桥体不承担任何功能引导,最后抛光成形。

1.3 临床观察评估

1.3.1 美学效果和牙周状况评价 以6个月、1年、2年、3年为定期观察时间点,进行随访。主要评价指标选择牙体完整性、邻接关系、邻边缘变色、边缘密合性、牙龈状况5个方面,评估参照改良美国公共卫生协会(United States Public Health Service, USPHS)修复体评价标准[9],见表1。

1.3.2 满意度评价 修复1年后,用视觉模拟评分法(VAS)调查患者对修复体颜色匹配度、形态、舒适度等的满意度。总分为10分,0~3分为不满意,4~6分基本满意,7~10分满意。总满意率=基本满意率+满意率。

表1 USPHS修复体评价标准

Table 1 Evaluation criteria of prosthesis from USPHS

Category	Degree	Characteristic
Tooth integrity	A	The dental tissue is in good condition without fracture or splitting
	B	Fractures or splits of dental tissue
	C	The tooth has loosened or lopped
Adjacency relation	A	The prosthesis is in close contact with adjacent teeth without food impaction
	B	There is food impaction, but it is easy to clean up
	C	There is food impaction, but it is not easy to clean up
Marginal discoloration	A	No visual evidence of discoloration
	B	Discoloration without penetration in pulpal direction
	C	Discoloration with penetration in pulpal direction
Marginal adaptation	A	There is no visible evidence of a crevice along the margin into which the explorer will penetrate
	B	There is visible evidence of a crevice along margin into which the explorer will penetrate or catch
	C	The explorer penetrates the crevice and dentin or base is exposed
Gingival status	A	The gums are healthy with no probing bleeding and no receding gums
	B	Mild gingival inflammation or mild gums atrophy, but does not affect the aesthetics
	C	The gums are red, swollen and bleeding, and the periodontal pocket is deepened or the gums are receded

USPHS: United States Public Health Service

1.3.3 并发症 主要对修复体脱落、折裂、继发龋、术后过敏进行统计。

2 结果

2.1 美学效果评价

1件修复体3个月内发生折裂,剩余48件修复体在6个月、1年、2年、3年的随访中,美学修复效果的等级,包括牙体完整性、邻接关系、邻边缘变色、边缘密合性、牙龈状况均评定为A级。

2.2 牙周健康状况

修复后患者咀嚼功能恢复良好,口腔卫生维护良好,基牙及桥体下方牙龈无明显红肿,呈现良好的龈缘状态,牙周健康状况良好。修复后X线片示:基牙牙周膜间隙无异常,缺牙区及基牙牙槽嵴高度无明显改变,周围硬骨板连续且清晰,牙槽骨未见进一步吸收。

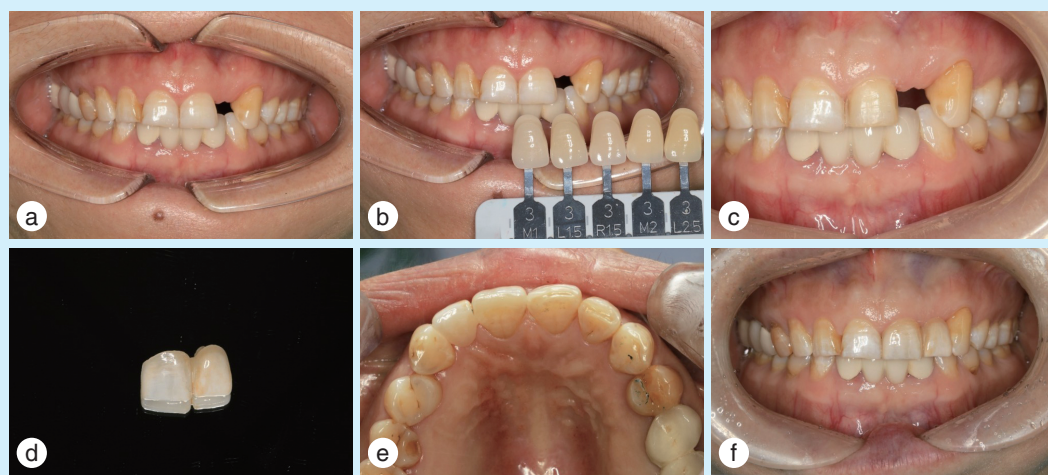
2.3 并发症及满意度

全部49件修复体,1例3个月内连接体处发生断裂,1例修复体于修复后第22个月发生脱落。VAS平均得分(7.4±1.3)分,患者对治疗过程和修复效果的主观评价均较满意。

2.4 典型病例

病例1,女,45岁,轻度氟斑牙患者,左上前牙拔除术后3个月,要求修复。临床检查:22缺失,21、23无松动,叩痛(-),牙龈退缩约1mm,咬合关系正常,正常覆殆覆盖,15-17、32-42烤瓷联冠修复。临床诊断:①上牙列缺损;②轻度氟斑牙。治疗计划:患者要求改善21牙齿颜色,并且想要修复效果自然协调,故拟采用以21为基牙的二硅酸锂基玻璃陶瓷单端树脂粘接桥修复22。治疗过程:进行前牙区美学设计,按唇侧全贴面型固位体的设计方式行21牙体预备,送加工厂完成修复体制作后进行试戴和粘接。修复完成后情况:修复后达到理想的颜色效果,咬合关系良好;无殆干扰;牙周牙体组织健康;患者满意度高,见图2。

病例2,男,21岁,下颌侧切牙先天缺失,要求修复。临床检查:32、42缺失,缺牙间隙正常,缺牙区牙槽嵴吸收呈刃状,牙龈退缩约1mm,31、41略向近中舌侧扭转,31、41近中颈部牙龈退缩形成黑三角,31、41无松动,叩痛(-),正常覆殆覆盖。临床诊断:①下牙列缺损;②下牙列不齐。修复治疗计划:患者强调美观,既不接受活动义齿修复又不



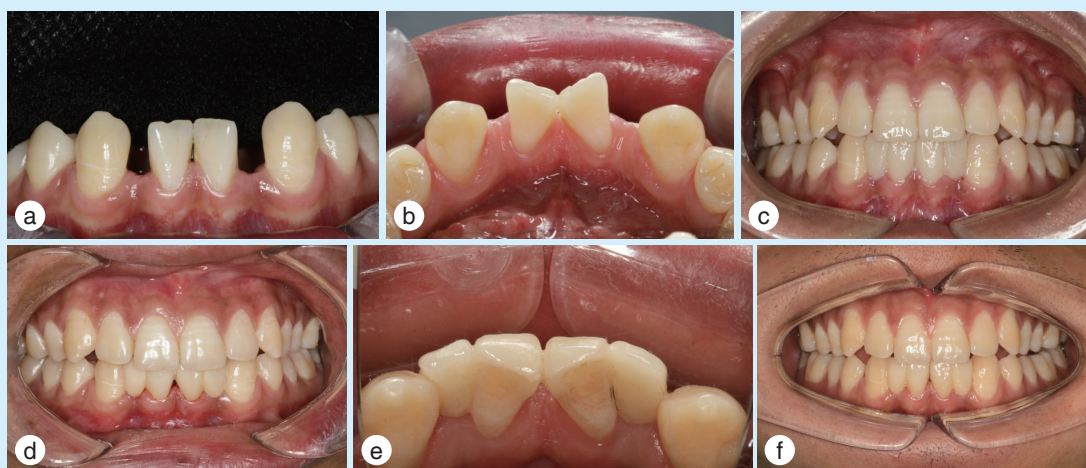
a: intraoral frontal view before restoration, the left maxillary lateral incisor was missing, which affects the appearance; b: shade matching, the left maxillary lateral incisor was restored with a lithium disilicate glass ceramic cantilever resin-bonded fixed partial denture bridge using the left maxillary central incisor as the abutment tooth; c: tooth preparation; the abutment tooth was prepared, and the preparation depth was controlled within 0.5 mm of enamel; d: the finished prosthesis, the labial surface of left maxillary central incisor is fully veneer and left maxillary lateral incisor is a bridge; e: intraoral palatal view after restoration; f: intraoral frontal view after restoration, after the restoration, the patient's dental arch is more symmetrical, more complete, and more aesthetically pleasing. The occlusion becomes more balanced, and the teeth can be maintained in the correct position

Figure 2 Typical case of lithium disilicate glass ceramic cantilever resin-bonded fixed partial denture in the restoration of single anterior tooth loss in maxillary

图2 二硅酸锂基玻璃陶瓷单端树脂粘接桥修复上颌个别前牙缺失典型病例

接受磨除过多的牙体组织,因局部解剖条件的限制暂不能种植修复,故拟采用下颌以31、41为基牙的二硅酸锂基玻璃陶瓷单端树脂粘接桥修复。治疗过程:进行前牙区美学设计,31、41进行唇侧全贴面型牙体预备,口腔模型制备,送加工厂制作修复体,试戴后进行粘接。修复完成后情况:31、41

近中舌侧扭转得到改善,减小了黑三角,可承担正常的生理功能,正中咬合时保持轻接触,前伸和侧方咬合时均无殆干扰,患者满意度高,修复后6个月、1年、2年、3年复诊,修复体完整,基牙无松动和移位,无边缘着色和继发龋,见图3。



a: mandibular intraoral frontal view before restoration, the left and right mandibular incisors were missing, the space of the missing tooth was normal, the alveolar ridge in the missing tooth area was absorbed in a cutting edge shape, and the gingival recession was approximately 1 mm. The left and right mandibular incisors slightly twisted to the mesial lingual side, the gingiva receded and formed a black triangle; b: mandibular intraoral palatal view before restoration; c: temporary prosthesis, it provided diagnostic information on shape, position, aesthetics and protected dental pulp from external adverse stimuli; d: intraoral frontal view immediately after restoration, mesiolingual torsion of mandibular left and right central incisors was improved and the black triangle was reduced; e: intraoral palatal view after one year, the marginal tightness was grade A, no secondary caries and shade in margin of the retainers had been found; f: intraoral frontal view after one year, the prosthesis was intact, with no loosening or displacement of the abutment tooth, and the periodontal status of the abutment tooth was stable

Figure 3 Typical case of lithium disilicate glass ceramic cantilever resin-bonded fixed partial denture in the repair of single anterior tooth loss in mandibular

图3 二硅酸锂基玻璃陶瓷单端树脂粘接桥修复下颌个别前牙缺失典型病例

3 讨论

目前全瓷粘接桥主要有二硅酸锂基玻璃陶瓷和氧化锆陶瓷。与氧化锆相比,二硅酸锂基玻璃陶瓷的强度不如氧化锆陶瓷^[10],据报道,以IPS e.max press为代表的新一代二硅酸锂基玻璃陶瓷修复材料的双轴挠曲强度 $> 400 \text{ MPa}$ ^[11],而前牙弓区的平均正常咀嚼力为30 N,理论上IPS e.max Press抗断裂韧性完全能满足前牙弓区的机械抗力要求。粘接桥的固位主要靠粘接力^[12],而硅酸盐类修复体的临床粘接成功率比氧化锆更高^[13]。二硅酸锂基玻璃陶瓷经氢氟酸酸蚀后,配合应用硅烷偶联法可与树脂粘接剂产生良好的机械化学嵌合作用而增强粘接效果^[14-15]。此外,二硅酸锂基玻璃陶瓷因具有出色的美学仿真性、良好的生物相

容性及粘接性等优势^[16-17],被广泛应用于前牙美学修复中。本研究纳入的全部修复体取得了良好的美学修复效果,仅有1例粘接桥发生脱落,分析脱落原因可能是其单固位体的设计及缺牙区软组织的阻挡造成就位时发生倾斜或扭转,经定位咬合板准确就位后再粘接,未再出现脱落问题。

树脂粘接桥是在牙周树脂夹板基础上演变而来的一种临时修复体,根据涉及基牙的数目,粘接桥可分为单端和双端式粘接桥。双端粘接桥粘接面积大,能够更好地分散修复体所受的咬合力,对于松动的基牙还能起到牙周夹板的作用。Kern等^[18]的15年随访结果发现前牙单端粘接桥比双端粘接桥有更长期的临床寿命。Wong等^[19]在模拟前牙咬合力情况下进行12 000次循环加载后,单

端粘接桥显示出比双端粘接桥更高的抗疲劳强度。单端粘接桥远期存留率高与桥体的运动方向与基牙一致有关,单端式设计能尽量避免基牙与桥体之间出现较大的剪切力和扭矩力^[20]。对基牙而言,单端粘接桥的安全性更高,因为单端粘接桥可将过大的倾斜力传递给基牙,基牙的牙周膜感受器能使患者敏锐地感知到,这可能会提醒患者避免应力过载^[21]。有研究表明,当咬合和邻接恢复良好时,并未发现单端粘接桥的基牙有旋转和倾斜移位的情况^[22]。双端粘接桥两侧基牙动度不一致,尤其是在前伸殆和侧向殆时,在粘接界面产生的应力集中会导致内部结构发生断裂,常发生于连接体处^[23]。当单侧断裂时,患者会因双端粘接桥可以继续发挥单端粘接桥的作用而不易察觉到断裂处下方继发龋的发展,因此,继发龋也往往发生在断裂处^[24]。此外,单端粘接桥只有一个基牙,牙线可以从桥体和非基牙侧的邻牙间进入,使口腔卫生的清洁维护更加简便。本研究对49例修复体的随访中,基牙牙龈无红肿、无松动,根尖周未见异常。这说明桥体设计合理可将生理性负荷的刺激传递给牙周组织,分散了单颗基牙的负荷,兼顾了咀嚼功能的恢复和牙周组织的保健。在青少年前牙缺失病例中,其牙槽骨仍有垂直向生长的潜力,且牙髓腔较大,许多修复方式受到限制。单端树脂粘接桥生物相容性好,能长期稳定地维持间隙和保护基牙,若采用此种修复方式,患者成年后可更根据需要去除或再次操作,是一种微创可逆的修复方式。

严格的术前评估及确定诊疗方案极其重要。术前患者的牙周疾患未得到有效控制,基牙松动加剧。对于后牙等咬合力较大的牙位和釉质粘接面积较小的牙位,应考虑采用双端式设计。虽然固位体设计多是舌腭侧翼板,但遇到基牙唇侧釉质发育不全、牙齿轻度扭转、要求改善牙齿颜色的患者时,可采用唇侧全贴面型或局部贴面型固位体的设计。对咬合情况不佳的患者,谨慎使用单端全瓷树脂粘接桥修复,本研究中有1例在术后3个月内就发生修复体折裂,从诊断模型上发现下前牙切端咬合于上前牙舌侧1/3以上,由于固位翼厚度和连接体空间不足,术后较短时间就会发生断裂,此类病例建议前期先接受正畸治疗调整咬合^[25],后续再进行修复。评估修复美学风险时,使用诊断蜡型进行口内模拟可将期望的修复效果可视化,可得到快速的临床反馈,有利于优化调整治

疗决策。另外,此类修复需加强口腔卫生宣教,并且需定期复查以便医师及时掌握修复体和基牙的情况并进行必要的维护。

二硅酸锂基玻璃陶瓷单端树脂粘接桥是一种可靠的前牙缺失美容修复方法,其短期修复效果令人满意,越来越被医生和患者所接受。单端树脂粘接桥研究前景宽广,本研究的随访时间短,在远期成功率方面还需进一步深入研究。

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