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· 防治实践 ·

四维微笑设计辅助非对称面型前牙超薄瓷贴面修复前牙区散在间隙1例及文献复习

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【摘要】 目的 探讨以四维微笑设计为主导、以面部流线为参考体系的全程数字化设计在前牙美学修复中的应用效果。方法 对1例前牙区散在间隙患者进行四维微笑设计,辅助行超薄瓷贴面数字化美学修复。通过口内和面部扫描获得患者数字化信息,进行四维微笑设计和预测,进行2次美学预告,医患共同确定治疗方案后,进行微创基牙预备,制作超薄瓷贴面,就位后粘接。术后观察美观度、边缘密合度,于修复完成后1年复查。结果 超薄瓷贴面边缘密合,颜色过渡自然,红白美学效果好,微笑时面部协调,1年后随访,颜面整体美学佳,基牙、牙周组织健康,患者满意。文献复习结果表明,时序性面部扫描与口内扫描数据拟合可以准确地进行四维微笑美学预测,模拟动态微笑及发音过程的真实状态,结合面部流线,为非对称面型患者设计出自然协调的个性化微笑;然而对于咬合改变、咬合不稳定或颞下颌关节紊乱患者,需增加电子面弓、锥形束CT等数据拟合,更加准确地模拟患者术后的下颌运动。结论 以四维微笑设计为主导、以面部流线为参考体系的全程数字化设计,辅助非对称面型前牙超薄瓷贴面的修复前牙散在间隙的效果良好,患者术后微笑协调美观,符合预期效果;患者参与度、满意度高,值得临床推广。

【关键词】 四维微笑设计; 数字化; 面部流线; 超薄瓷贴面; 非对称面型; 前牙间隙; 美学修复; 面部扫描; 口内扫描

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Anterior aesthetic restoration with ultrathin porcelain veneers on asymmetric faces assisted by a four-dimensional smile design: a case report and literature review WANG Hao, ZHANG Xidan, REN Wei, YUE Li, GAN Xueqi.

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【Abstract】 Objective To explore the application effect of a four-dimensional smile design as the leading and facial streamline as the reference system in the aesthetic restoration of anterior teeth. **Methods** A case of scattered space in anterior teeth was treated with a four-dimensional smile design and digital aesthetic restoration with ultrathin porcelain veneer. The digital information of the patients was obtained through oral and facial scanning, and a four-dimensional smile design and prediction were carried out. After the treatment plan was jointly determined by doctors and patients, minimally invasive abutment preparation was carried out, and ultrathin porcelain veneer was made and bonded in place. After the operation, the esthetic degree and marginal fit were observed and reexamined one year after the repair. **Results** The edges of the ultrathin ceramic veneers were naturally tight, and the color was coordinated, with satisfying pink and white esthetics. The face was more harmonious and natural when smiling. One year after the restoration, the facial aesthetics were wonderful, the abutment teeth and periodontal tissues were healthy, and the patients were satisfied.

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The results of the literature review showed that the fitting of temporal facial scanning and intraoral scanning data can accurately predict four-dimensional smile aesthetics, simulate the real state of the dynamic smile and pronunciation process, and combine it with facial streamlines to design a natural and coordinated personalized smile for patients with asymmetric faces. However, for patients with occlusal changes, unstable occlusion or temporomandibular joint disorder, it is necessary to add data fitting, such as electronic facial arch and cone beam CT, to more accurately simulate postoperative mandibular movement. **Conclusion** With a four-dimensional smile design as the leading and facial streamline as the reference system, the whole process digital design assisted the restoration of asymmetric anterior teeth with ultrathin porcelain veneer and had a good effect. The postoperative smiling of patients is harmonious and beautiful, which is in line with the expected effect. Patient participation and satisfaction are high; thus, this method is worthy of clinical promotion.

【Key words】 four-dimensional smile design; digital; facial flow line; ultrathin ceramic veneer; asymmetrically face; gaps of the anterior teeth; aesthetic restoration; facial scans; intraoral scanning

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口腔美学是颜面部美学的重要组成部分,微笑时露出美观、健康、协调的牙列是患者和口腔医师的共同目标。数字化微笑设计是以科学、艺术和自然美学为原则、以临床诊断数据为基础,运用数字化技术实现私人微笑的订制^[1-2]。近年来,四维微笑设计逐渐成为国内外研究热点,将三维口内与面部成像相结合进行微笑设计,并在动态微笑过程中不断调整优化,最大程度地提高美学预测的准确性和可视化^[3-5]。本病例通过对1例四维微笑设计辅助非对称面型超薄瓷贴面修复前牙散在间隙的患者病例回顾及文献复习,探讨以四维微笑设计为主导、以面部流线为参考体系的全程数字化设计在前牙美学修复中的应用。

1 资料和方法

1.1 病历资料

患者,女,37岁。因“前牙牙缝过大,影响美观10年余”就诊。患者自诉10年来前牙牙缝过大,影响美观,要求关闭前牙间隙。定期洁牙史,无口腔治疗史,无夜磨牙或紧咬牙等不良咬合习惯。否认系统性疾病史,无过敏史,既往史、家族史无特殊。

面部检查:面部对称性欠佳,颏点偏右侧(图1a);面下1/3垂直高度正常;中位笑线。患者发音时牙齿暴露量正常(图1b)。口内检查:前牙散在间隙,11-12牙之间约1.3 mm,11-21之间约1.6 mm,21-22之间约1 mm,31-32之间约1 mm。12、22过小畸形,腭向错位(图1c)。12-22、31、32牙体不松动,无叩痛,牙色正常。牙列完整,中线齐,后牙中

性关系,无干扰等情况。下颌运动及咬合相关功能检查:开口度、开口型未见异常,下颌运动无偏斜、无障碍。双侧颞下颌关节区无扪痛,髁突运动对称,关节无弹响、杂音。前伸运动11、21引导,侧方运动13、12、23引导。

诊断:①12-22、31-32牙间隙;②12、22过小牙。

治疗计划:患者希望尽快修复前牙间隙,拒绝正畸治疗。基于美观和微创的考虑,本病例拟采用超薄贴面的修复方式。

治疗方案:①牙周基础治疗,②12-22、31-32瓷贴面修复。

1.2 治疗过程

1.2.1 咬合与面部的数字化资料采集 完成牙周基础治疗后,制取模型,行口内扫描(3Shape, TRIOS, 丹麦),记录牙列形态及咬合关系(图2a)。采用相机(EOS 6D2, Canon, 日本)记录面型及口内咬合状态,使用面部扫描仪(Dynamic 4D, 3dMD, 美国)对微笑发音等运动过程进行全程记录(图2b)。

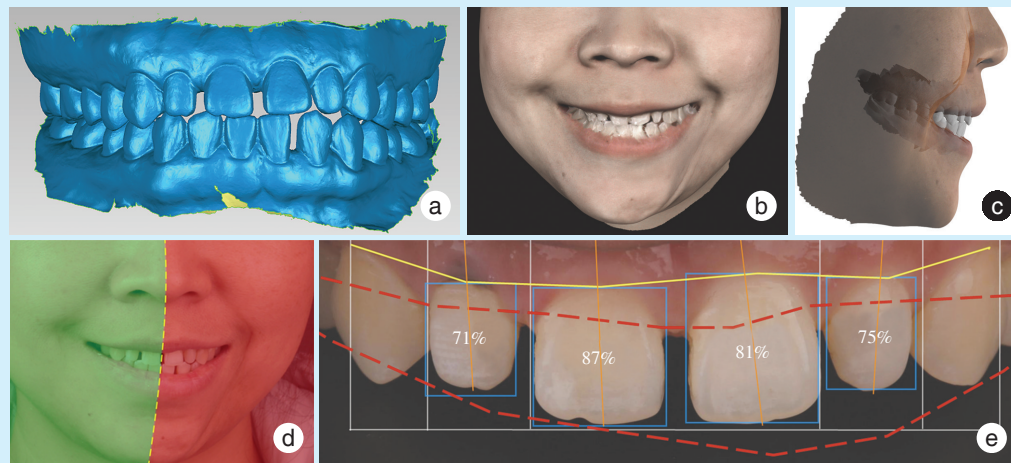
1.2.2 数字化四维微笑设计 将牙列模型及咬合关系的STL文件导入到逆向工程软件(Geomagic Wrap 2017, 3D Systems)中,通过“N点对齐”与特征性的面部扫描数据拟合后进行美学评估(图2c),导出为OBJ格式文件后,再于3D制作软件(3ds-MAX, Autodesk)中进行设计调整。选用面部流线作为牙列中线的参考,进行个性化微笑设计(图2d)。前牙美学分析显示,患者牙龈曲线稍不协调,前牙散在间隙,牙体长轴方向、冠宽长比例不协调(图2e)。考虑到患者个人意愿以及中位笑



a: smile analysis, the facial symmetry is not good, and the chin point is on the right side; b: pronunciation analysis, the pronunciation from left to right is M, E and F/V, the exposure of teeth is normal; c: intraoral view, the anterior teeth were scattered in the space, approximately 1.3 mm between 11 and 12, approximately 1.6 mm between 11 and 21, approximately 1 mm between 21 and 22, and approximately 1 mm between 31 and 32 teeth; and 12-22 malformed, palatal malposition

Figure 1 Facial analysis and intraoral examination of patients with scattered space in anterior teeth

图1 前牙区散在间隙患者面部分分析及口内检查



a: digital dental cast; b: three-dimensional face scans of smiling process; c: alignment of 3D digital dental cast and digital facial images; d: analysis of facial flow line, the facial streamline was selected as the reference of the midline of dentition; e: aesthetic analysis of anterior teeth, the gingival curve of the patient was slightly discordant, the anterior teeth were scattered in the space, the direction of the long axis of the tooth and the ratio of crown width to length were discordant

Figure 2 Digital data of patients and four-dimensional smile design of patients with scattered space in anterior teeth

图2 前牙区散在间隙患者数字化资料收集与四维微笑设计

线,美学设计只干预牙体形态。

1.2.3 第一次美学预告 将三维美学蜡型与患者微笑、发音的时间序列面部扫描数据相拟合(图3a),根据牙列与颜面协调性进行进一步的精细化调整,形成第一次的四维美学预告。医生、患者、技师三方沟通,协作审美设计,共同决策获得最佳的美学蜡型(图3b)。

1.2.4 第二次美学预告 该患者的贴面设计均为增量型^[6],因此可在不备牙的前提下实现美学蜡型的口内模拟,进行第二次美学预告(图3c)。同时,进行第二次医患技协作审美设计,于患者口内将临时修复体调整至满意后,记录此时的牙列模型,修整后转化为数字化模型,在最终修复体数字化设计的过程中进行拟合比对,指导设计和制作(图3d)。



1.2.5 微创牙体预备与贴面的试戴及粘接 在临时贴面和硅橡胶导板的引导下进行微创基牙预备,仅于邻面区域预备出浅凹形终止边缘。牙体预备后,口内成像获取牙列模型及咬合关系,比色。配戴临时贴面。制作12-22近中、32近中及31远中邻面的超薄部分贴面;去除临时贴面,清洁基牙,抛光;采用3M RelyX Venera瓷贴面粘接套装,使用TR色试色糊剂于患者口内试戴,检查贴面的颜色、形态、边缘密合度、悬突、邻接触关系等,再次与患者确认美学效果。贴面的组织面清洗并干燥后,氢氟酸酸蚀,涂布硅烷偶联剂,并吹薄吹匀。清洁的牙面磷酸酸蚀后,涂布釉质粘接剂。最后再以TR色树脂水门汀进行粘接,贴面就位后光固化,去净多余的粘接剂,调殆,抛光。见图4。

2 结果

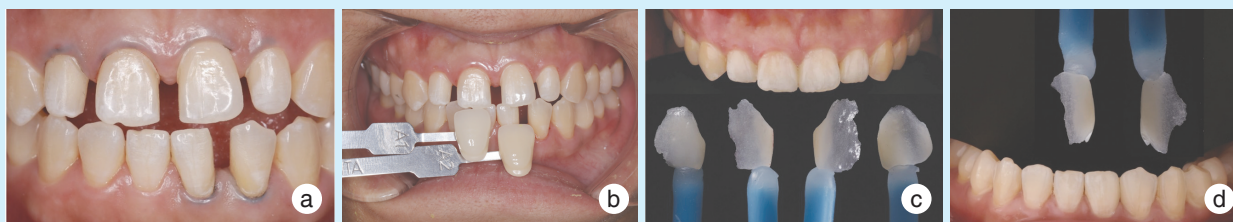
患者完成修复后即刻,可见前牙散在间隙关闭,牙齿的长宽比、轴向更加均匀自然,根据FDI修

复体临床评价标准^[7]对修复体进行评价,修复后即刻的贴面色泽与釉质相似,无表面染色,颜色匹配通透性好,解剖形态完美,边缘密合,无间隙白线,无折裂或裂纹,邻接触点正常,牙髓活力正常,术后无敏感,修复体周围软组织健康。软硬组织协调,正中咬合时前牙无接触,前伸运动中,前牙均匀引导,贴面修复体避开功能运动接触区域1 mm以上。1年后复诊时,贴面颜色自然协调,无边缘染色,形态完好,无折裂或裂纹,边缘密合,无继发龋等病理性改变,牙龈色泽粉红,牙周组织健康,微笑自然协调,患者满意度高。见图5。

3 讨论

3.1 四维微笑设计

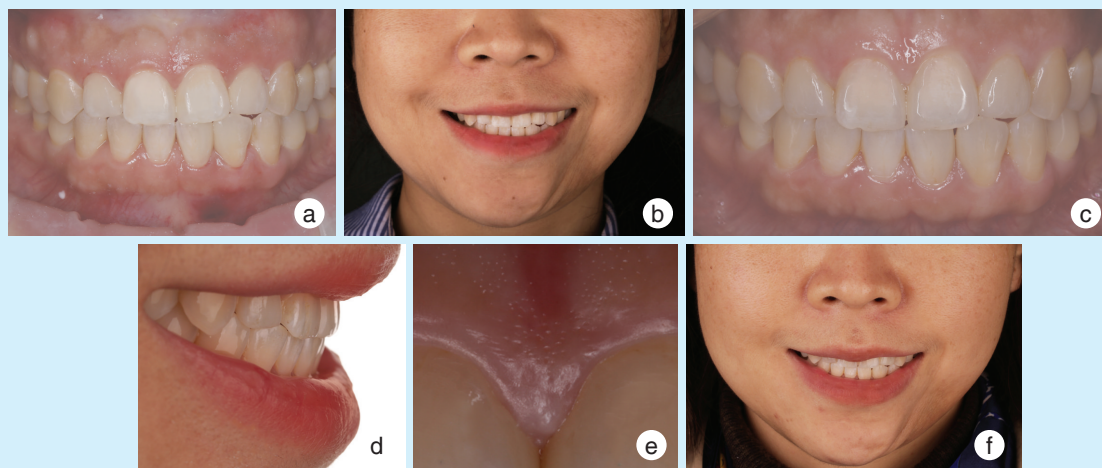
微笑设计要把握微观审美与宏观审美的统一。数码照片无法捕获整个微笑过程以还原三维运动的自然状态,据此展开的美学评估和治疗计划设计并不准确^[8]。因此,为了更好地模拟患者微



a: minimally invasive dental preparation; b: shade selection; c: try on upper jaw, 12-22 mesial ultrathin adjacent partial veneers; d: try on lower jaw, 32 mesial and 31 distal ultrathin adjacent partial veneers

Figure 4 Operation process of ultrathin porcelain veneer for asymmetric anterior teeth for restoration of scattered spaces in anterior teeth

图4 非对称面型前牙超薄瓷贴面修复前牙区散在间隙的手术过程



a: intraoral imaging immediately after operation, it can be seen that the anterior teeth are scattered in the gap, and the length width ratio and axial direction of the teeth are more uniform and natural; b: smile after surgery; c-e: intraoral imaging one year after operation, showing that the color of the veneer is natural and harmonious, no edge staining, good shape, no fracture or crack, no secondary caries and other pathological changes, the gingival color is pink, and the periodontal tissue is healthy; f: smile one year after operation

Figure 5 Effect of four-dimensional smile design assisted asymmetric anterior teeth with ultra-thin porcelain veneer on restoration of scattered spaces in anterior teeth

图5 四维微笑设计辅助非对称面型前牙超薄瓷贴面修复前牙区散在间隙的效果

笑的真实状态, Ye等^[5]通过拟合三维虚拟蜡型和面部扫描制作了四维美学预测, 应用于医患技审美决策, 获得满意的修复效果; Jreige等^[4]通过拟合口内扫描与面部扫描的三维数据构建四维虚拟患者, 并将微笑设计在虚拟患者口内进行复刻和调整, 实现全角度的治疗预测。本病例中, 笔者采用四维微笑设计为非对称面型患者提供准确的美学预告, 将微笑设计的美学蜡型通过Geomagic软件的“N点对齐”工具, 拟合至面部扫描模型进行全角度的验证和精调, 最后在时间序列中还原微笑过程的真实状态, 实现对修复效果的四维展示。该技术可以实现从任意角度和任意时间点来检查微

笑设计, 在设计过程中动态展示治疗计划和预期效果, 并根据患者的反馈进行更改, 患者主动参与决策, 保证了美学效果符合意愿^[9]; 最后, 由患者参与设计的四维微笑设计, 可以通过数字化美学蜡型转移到修复体上。对于咬合改变、咬合不稳定或颞下颌关节紊乱患者, 还需要增加电子面弓、锥形束CT等数据拟合, 来构建更加完整的四维虚拟模型, 准确地模拟下颌运动。然而由于精度差别导致的数据拟合误差仍需关注; 此外, 面部扫描所呈现的模型色彩失真是美学设计和沟通的阻碍。

3.2 面部流线

在临床中, 常使用面中线定位牙列中线, 且该

参考指标建立于面部对称的基础上^[10]。然而Silva等^[11]研究表明非对称面型中患者鼻子与下巴的偏斜方向会影响人们对牙列中线位置的视觉感受,因此该类患者亟待选择更为适合的参考体系。Silva等^[12]提出,由微笑时眉间、鼻梁、人中、颏点构成的面部流线参考系,更好地反映了面部各组织结构的相对位置和协作关系,使得面部不对称患者的微笑设计更加协调美观。本病例中,患者鼻尖和下巴向右偏斜,发音、微笑时尤其明显。因此设计的上牙列中线顺着偏斜方向落在右侧,以减少视觉冲击感。

3.3 超薄瓷贴面

超薄瓷贴面可将牙体预备量减少至0.2~0.3 mm,甚至不备牙,可以最大程度上保留牙釉质并获得牢固的釉质粘接,是口腔修复中最保守的治疗方法之一。其修复体的主体厚度低于0.5 mm,最薄处仅约0.2 mm,常使用二硅酸锂基、长石质、或白榴石玻璃陶瓷制作而成,其中长石质玻璃陶瓷的半透明性最佳^[13]。本病例患者为年轻女性,主诉关闭前牙间隙,拒绝正畸,属增量型修复,美学要求较高,邻面超薄部分贴面应是其理想的修复方式。本病例中,患者12、22为过小牙,腭向错位,因此,在设计中不仅进行了间隙分配,而且在侧切牙的唇侧也做了适当的增量,以使上前牙更加美观协调。在牙体预备前,先于口内制作树脂饰面指导备牙,预备后采用硅橡胶导板检查预备量,确保最微创的预备和足够的修复空间,达到保守治疗的目的。同时,有效避免了牙体敏感,减少微渗漏和继发龋,保留足够的釉质粘接面积,使修复的远期成功率显著提高^[14]。在精准的口内扫描支持下,渐薄的边缘设计不仅满足了边缘密合的要求,更获得了自然的形态过渡。

【Author contributions】 Wang H collected case material and wrote the article. Zhang XD, Ren W and Yue L revised the article. Gan XQ performed aesthetic restoration and reviewed the article. All authors read and approved the final manuscript as submitted.

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