[DOI]10.12016/j.issn.2096-1456.2023.11.006

·临床研究·

数字化定位导板在上颌完全骨埋伏多生牙拔除术中的应用

刘伯彦[1]，　曾维[1]，　尹华强[2]，　汤炜[1]
1. 口腔疾病研究国家重点实验室，国家口腔疾病临床医学研究中心，四川大学华西口腔医院口腔颌面外科，四川 成都（610041）；　2. 成都市第一人民医院口腔科，四川 成都（610095）

【摘要】　目的　评价应用数字化定位导板拔除上颌完全骨埋伏多生牙的临床疗效，以期为临床应用提供技术方案。**方法**　获得医院伦理委员会审批及患者知情同意，分析2016年1月至2022年4月期间的136例上颌完全骨埋伏多生牙患者的数据。纳入的病例根据导板使用情况分为两组，试验组为使用数字化定位导板的病例（71例），对照组为未使用导板的病例（65例）。对手术时间、并发症等进行统计分析，评价其临床疗效。**结果**　所有患者均顺利完成手术；试验组平均手术时间为（21.5 ± 3.4）min，小于对照组的时间（27.2 ± 4.9）min（t = 7.599，P < 0.001）；术后1周复查，试验组均未出现邻牙、神经损伤等并发症，对照组出现邻牙损伤2例，牙龈麻木不适3例。**结论**　数字化定位导板可有效缩短上颌完全骨埋伏多生牙拔除术时间，是辅助临床上颌完全骨埋伏多生牙拔除的有效手段。

【关键词】　数字化技术；　数字化定位导板；　手术入路；　完全埋伏多生牙；　导板；　定位；　微创拔牙；　3D打印
【中图分类号】　R78　**【文献标志码】**　A　**【文章编号】**　2096-1456（2023）11-0801-06
【引用著录格式】　刘伯彦，曾维，尹华强，等. 数字化定位导板在上颌完全骨埋伏多生牙拔除术中的应用[J]. 口腔疾病防治，2023，31(11)：801-806. doi:10.12016/j.issn.2096-1456.2023.11.006.

微信公众号

Clinical application of a digital positioning guide template during the extraction of maxillary wholly impacted supernumerary teeth

LIU Boyan[1], ZENG Wei[1], YIN Huaqiang[2], TANG Wei[1].　1. State Key Laboratory of Oral Diseases & National Clinical Research Center for Oral Diseases & Department of Oral and Maxillofacial Surgery, West China Hospital of Stomatology, Sichuan University, Chengdu 610041, China; 2. Department of Stomatology, Chengdu First People's Hospital, Chengdu 610095 , China
Corresponding authors: TANG Wei, Email: mydrtw@vip.sina.com , Tel: 86-28-85503456

【Abstract】　Objective　To evaluate the clinical efficacy of positioning guide templates for maxillary wholly impacted supernumerary teeth to provide technological solutions for clinical applications. **Methods**　After approval by the hospital ethics committee and informed consent given by the patients. Data from 136 patients with maxillary wholly impacted supernumerary teeth from January 2016 to April 2022 were analyzed retrospectively. The patients were divided into two groups according to the usage of the positioning guide template. The experimental group included patients using the positioning guide template (71 cases), and the control group did not use the positioning guide template (65 cases). The operation time and complications were statistically analyzed to evaluate the clinical efficacy after surgery. **Results**　All operations were successfully completed. The average operation time in the experimental group was (21.5 ± 3.4) min, significantly shorter than that in the control group (27.2 ± 4.9) min. There were statistically significant differences between the experimental and control groups (t = 7.599, P < 0.001). One week after the operation, there were no complications in the experimental group, and there were 2 cases of adjacent tooth injury and 3 cases of gingival numb-

【收稿日期】2022-12-21；　**【修回日期】**2023-02-06
【基金项目】四川省区域创新合作项目（2020YFQ0012）
【作者简介】刘伯彦，博士研究生，Email: 2669481902@qq.com
【通信作者】汤炜，教授，博士，Email: mydrtw@vip.sina.com，Tel: 86-28-85503456

ness in the control group. **Conclusion**　A digital positioning guide template can effectively shorten the time of maxillary wholly impacted supernumerary teeth extraction and is an effective means to assist clinical maxillary wholly impacted supernumerary teeth extraction.

【Key words】 digital technology; digital positioning guide template; surgical approach; wholly impacted supernumerary teeth; guide template; positioning; minimally invasive tooth extraction; 3D printing

J Prev Treat Stomatol Dis, 2023, 31(11): 801-806.

【Competing interests】 The authors declare no competing interests.

This study was supported by Regional Innovation Cooperation Project of Sichuan Province (No. 2020YFQ0012).

多生牙是正常牙列数目之外的牙，大多位于上颌骨前牙区[1]，多见于男性[2-3]，常伴有牙列不齐、恒牙迟萌、邻牙牙根吸收、囊肿等临床症状[4-7]。也有因多生牙感染导致颅内感染的报道[8]。因此，多生牙应早期拔除[9-10]。对于完全骨埋伏的多生牙，传统方法定位困难，需要较广泛的去骨以探查多生牙，导致手术创伤大、耗时长，可能导致邻牙牙根损伤、神经损伤以及因过量开窗去骨导致的上颌畸形等并发症[11]。因此，对于完全骨埋伏多生牙，术中精确定位是避免上述风险的关键。数字化导板技术是辅助术前治疗计划精准实施的有效手段[12-13]，可实现病灶的精确定位和手术的微创实施，极大程度减少损伤和并发症[14-15]。Jo等[16]首次将此技术用于多生牙的拔除。目前，对于不同类型的上颌完全骨埋伏多生牙，仍不能确定采用何种手术入路能更好地保护周围重要结构及使用何种形式的导板可更精确地定位。因此，本研究拟提出新的定位导板设计与应用方案，评估其临床应用效果。

1　资料和方法

1.1　主要设备及软件

锥形束CT（cone beam CT，CBCT）（Morita 3D Accuitomo，日本）；MIMICS 16.0（Materialises Interactive Medical Image Control System，比利时）；Geomagic Studio 2013（Raindrop Geomagic，美国）；光固化SLA3D打印机（中瑞科技 SLA300，中国）。

1.2　研究对象

从2016年1月至2022年4月就诊于四川大学华西口腔医院创伤整形外科的患者中收集病例。纳入标准：①至少有1颗上颌完全骨埋伏多生牙；②埋伏多生牙影响恒牙萌出或正畸治疗需要手术拔除；③无拔牙手术禁忌证并要求手术拔除。排除标准：①未进行手术者；②术后随访失联的病例。将纳入的病例根据导板使用情况分为两组：使用定位导板的为试验组，未使用导板的为对照组。本研究获得了四川大学华西口腔医院伦理委员会审批（批号：WCHSIRB-TT-2015-056）。

本研究共纳入136例上颌完全骨埋伏多生牙的病例，试验组为使用数字化定位导板的病例，对照组为未使用导板的病例。试验组71例，其中男性44例，女性27例，年龄7～31岁，平均年龄22.4岁；对照组65例，其中男性35例，女性30例，年龄8～28岁，平均年龄20.9岁。

1.3　导板规划设计与应用方案

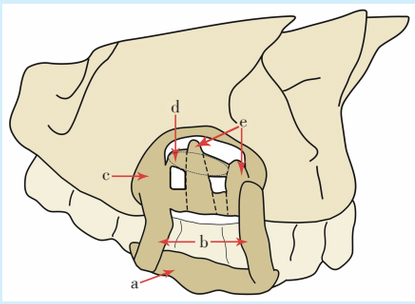
1.3.1　数据获取　获取患者颌面部CBCT数据。CBCT扫描时患者微张口，保持上下颌牙列处于非接触状态。

1.3.2　三维重建和测量分析　将获取的CBCT数据导入Mimics 16.0软件，分割并重建出多生牙、邻牙、周围骨组织、神经以及上颌窦等重要结构，进行三维测量分析，测量数据用于辅助后续导板设计。

1.3.3　导板设计　根据不同的应用场景，本研究提出两种定位导板设计方案。

①设计方案1：该导板适用于多生牙与邻牙位置关系密切，邻牙对多生牙拔除路线有阻挡的情况。导板由固位体、连接体、引导部3部分组成。固位体采用牙支持式；引导部设计成与骨面相贴的曲面，结合测量分析结果进行个性化设计，标记出多生牙位置以及开窗去骨范围。在引导部的设计中加入了提示邻牙位置的形态结构，标记多生牙与邻牙的位置关系，以强化定位作用，减小损伤周围组织结构的可能性。图1为该设计方案示意图，以颊侧入路举例。

②设计方案2：该导板适用于多生牙与邻牙位置关系不密切，邻牙对多生牙拔除路线无阻挡的情况。将引导部设计成内中空，大小为开窗去骨范围的立体结构。多生牙与最近侧骨面的距离为d，引导部的高度为f，以控制钻针（其工作长度e=



a: retainer; b: connector; c: guide part; d: supernumerary teeth (the oval dashed line in the figure); e: adjacent tooth root morphology. The blank part is used to guide the scope of the deboning area

Figure 1　Schematic diagram of the positioning guide template design when the position of the supernumerary teeth is closely related to the adjacent teeth and the adjacent teeth are blocking the extraction route of the supernumerary teeth

图1　多生牙与邻牙位置关系密切且邻牙对多生牙拔除路线有阻挡时导板设计的示意图

d+f)的深度,避免额外骨丧失。此设计方案只标记多生牙位置以及开窗去骨范围。图2为该设计方案示意图,以颊侧入路举例。

1.3.4　导板3D打印　将设计完成的导板保存为STL格式文件,并导入SLA300光固化机制作出导板实物,经低温等离子消毒后备用。

1.3.5　术中应用　试验组根据选择的导板设计应用方案,确定需要翻开的牙龈粘骨膜瓣范围,暴露骨面,就位导板,按照引导部指示的位置、深度和范围进行去骨,暴露多生牙,完成定位,记录手术时间,按照常规方法将多生牙完整拔除。对照组采用传统方式确定多生牙的位置,并且去骨暴露多生牙,完成定位,记录手术时间,按照常规方法将多生牙完整拔除。

1.3.6　术后评价与可行性分析　术后1周复查,评估是否出现损伤邻牙、神经、鼻底以及上颌窦等部位的并发症。比较试验组和对照组的手术时间、技术难易程度,评估导板技术的可行性。

1.4　统计学分析

采用SPSS 18.0软件进行数据处理,定量资料符合正态分布,数据用均数 ± 标准差表示,采用独立样本 t 检验进行统计学分析。$P < 0.05$ 为差异具有统计学意义。

2　结　果

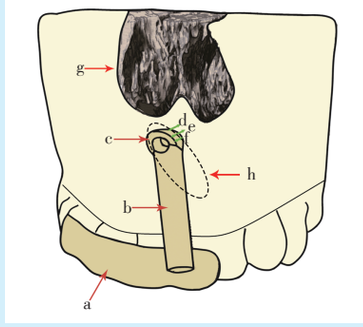
试验组手术时间为(21.5 ± 3.4)min,显著小于对照组的(27.2 ± 4.9)min,差异有统计学意义(t = 7.599,$P < 0.001$)。术后1周复查,试验组均未出现损伤邻牙、神经、鼻底及上颌窦等部位的并发症;对照组出现邻牙损伤2例,牙龈麻木不适3例。

典型病例1:患者女,21岁,诊断为右上颌多生牙(1颗);术前CBCT三维重建模型示多生牙位于13牙牙根腭侧,与唇侧和腭侧骨壁最短距离分别为1.83 mm、2.43 mm;因多生牙与邻牙关系紧密,邻牙阻挡了多生牙拔除线路,选择设计方案1,引导部标记了开窗去骨范围及多生牙与邻牙形态位置关系(图3)。

典型病例2:患者男,10岁,诊断为上颌前牙区多生牙(2颗);术前CBCT三维重建模型示上颌前牙区两颗多生牙;对于右侧多生牙(绿色),其距最近唇侧骨面为2.13 mm,最近腭侧骨面为1.16 mm;对于左侧多生牙(紫色),牙根部距最近腭侧骨面为2.01 mm,故采用腭侧入路;因多生牙与邻牙关系不密切,邻牙未阻挡多生牙拔除路线,选择设计方案2,引导部只标记开窗去骨范围(图4)。

3　讨　论

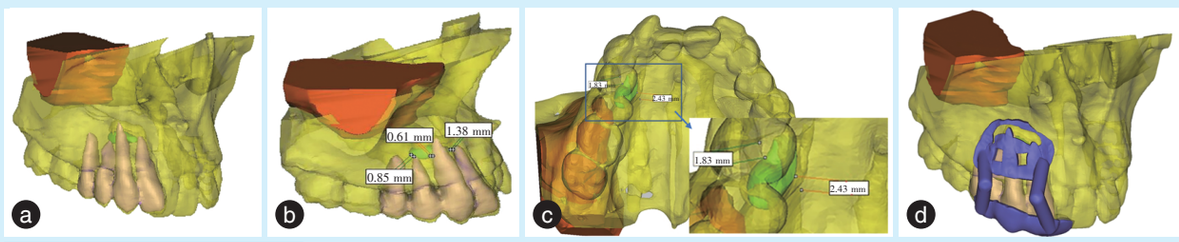
上颌完全骨埋伏多生牙的拔除,传统方法主要依靠二维影像以及医生临床经验制定手术方



a: retainer; b: connector; c: guide part; d: the distance between the supernumerary tooth and the nearest lateral bone surface; e: the working length of the drilling needle; f: height of the guide part; g: pyriform pore; h: supernumerary tooth (the oval dashed line in the figure)

Figure 2　Schematic diagram of the positioning guide template design when the position of the supernumerary teeth is not closely related to the adjacent teeth and the adjacent teeth do not obstruct access to the extraction of the supernumerary teeth

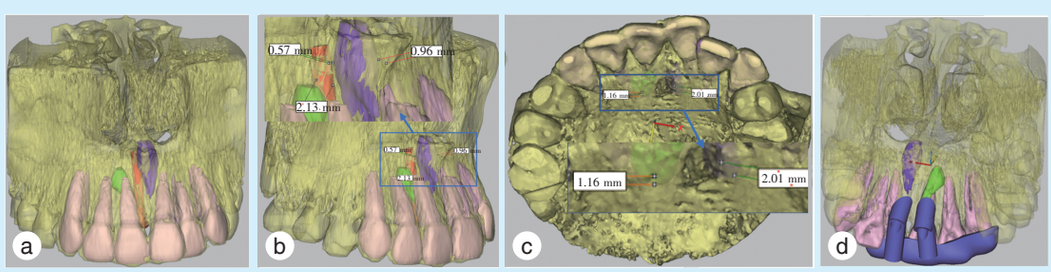
图2　多生牙与邻牙位置关系不密切且邻牙对多生牙拔除手术进路无阻挡时导板设计的示意图



a: the red part is the maxillary sinus, the green part is the supernumerary teeth; b: distance relationship between the supernumerary tooth and the canine, lateral incisor and premolar; c: distance between the supernumerary tooth and the bone wall; d: design of the guide template; e: intraoperative application

Figure 3　Application of the positioning guide template when the supernumerary teeth are closely positioned near the adjacent teeth and the adjacent teeth block access to the extraction of the supernumerary teeth

图3　多生牙与邻牙位置关系密切且邻牙对多生牙拔除手术进路有阻挡时定位导板的应用



a: the green part is the supernumerary tooth on the right side, the red part is the nasopalatine nerve, and the purple part is the supernumerary tooth on the left side; b: the distance between the supernumerary teeth and the labial bone wall and the distance between the supernumerary tooth on the left side and the nasopalatine nerve; c: the distance between the supernumerary teeth and the palatal bone wall; d: design of the guide template; e: intraoperative application

Figure 4　Application of the positioning guide template when the position of the supernumerary teeth is not closely related to the adjacent teeth and the adjacent teeth do not block access to the extraction of the supernumerary teeth

图4　多生牙与邻牙位置关系不密切且邻牙对多生牙拔除手术进路无阻挡时定位导板的应用

案[17-18]。使用传统方法拔除完全骨埋伏多生牙时，去骨量是无法预估的。医生在拔牙过程中需要依据多生牙显露情况不断调整去骨范围，可能会因为磨除方向欠佳而产生无效去骨或是低效去骨。随着CBCT应用于口腔颌面外科，医生可以从CBCT图像的冠状位、矢状位和水平位等3个层面了解多生牙位置及其邻近结构关系[19-21]。但CBCT图像并不能将其关系进行可视化显示，无法直接用于引导手术[22]。本研究借助专业的图像软件，对重要结构进行图像分割和三维重建，通过调整模型透明度实现重要结构的可视化，并完成三维测量分析。

近年来，有研究发现应用定位导板拔除多生牙，医生可以进行最优的去骨显露操作，符合外科手术精准化与微创化的理念[23]。Liu等[24]设计了一种引导部和固位体之间通过可插拔式结构连接的导板；Wang等[25]应用导板完成了上下颌共7颗多生牙的罕见病例的手术治疗；Yu等[26]根据黏膜下埋伏和骨埋伏多生牙的两种不同类型设计引导部的导板。上述定位导板引导部的设计相对简单，只能将术前设计规划的去骨位置及去骨范围转移到手术中。这种设计与本研究的设计方案二

类似，只适用于多生牙与邻牙关系不密切或是邻牙对拔除多生牙的手术路线无阻挡的情况。当多生牙与邻牙关系密切或是邻牙对拔除多生牙的手术路线有阻挡时，完成术前设计的去骨操作后，周围结构显露可能仍不清晰，暴露范围可能仍不足以将多生牙拔出，需要进一步去骨，但导板很难再提供有效的定位指导。医生只能再次回归到CBCT等影像学资料中，根据经验判断继续进行去骨操作，有损伤周围组织结构的可能性。本研究针对这种情况，在定位导板引导部中加入了提示邻牙位置的形态结构，即方案1中的设计；医生在拔牙手术中可以随时了解邻牙的位置，获得直观可视化的定位信息，在安全的范围内继续进行去骨操作，降低了邻牙损伤的可能性。

随着数字化技术在口腔颌面部的应用，导板技术成为术前规划设计方案的有效手段。尽管已有多生牙应用导板技术的文献[27-29]，但导板技术的普适性和可行性仍有待临床验证。本研究提出了新的导板设计和应用方案，尝试初步形成数字化导板辅助多生牙拔除的流程和规范。①数据获取：CBCT的空间分辨率高，较CT可获取精确的牙列数据，而为了获取精确的牙体形态，拍片时需保持上下颌牙处于非接触状态，以此保证导板固位体的稳定性。②术前规划：利用三维重建和可视化技术对感兴趣区域进行显示，结合三维测量分析结果，确定最适宜的导板设计方案。③导板设计：对于与邻牙位置关系密切的多生牙，建议在引导部的设计上加入提示邻牙位置的形态结构；对于位置关系不密切者，可酌情省略该设计，以减小引导部面积，缩小翻瓣切口，减小创伤。④术后评价：从定位时间和术后并发症两个方面对导板技术进行临床疗效的评估和可行性分析。

应用数字化导板技术辅助上颌多生牙拔除的优势：①优化传统手术步骤，缩短手术时间；②增加了手术的精准性和可预见性；③减少术后并发症。此外，数字化导板诊疗流程改变了以往的诊疗模式，从以往的“长术中模式”，即手术占据整个诊疗过程的大部分，改为“长术前模式”，即术前设计占据整个诊疗过程的大部分。这种“长术前模式”通过增加术前规划设计时间，借助手术模拟，可对手术的重点和难点进行预测，术前即可制定对应的处理方案，可更好地保护周围重要结构，因此可以在实际操作时缩短手术时间，降低损伤和并发症，这也更符合患者的切身利益。

4　小　结

综上所述，在拔除完全骨埋伏多生牙时，本研究设计的数字化定位导板较传统方式可节省手术时间、减少术后并发症。在导板的设计中加入了提示邻牙位置的形态结构，以减小邻牙损伤的可能性。数字化定位导板对临床诊疗具有指导价值，值得推广。

【Author contributions】 Liu BY designed the study, collected and analyzed the data, drafted the article. Zeng W, Yin HQ designed the study, collected and analyzed the data, revised the article. Tang W designed the study, guided and critically reviewed the article structures. All authors read and approved the final manuscript as submitted.

参考文献

[1] Suljkanovic N, Balic D, Begic N. Supernumerary and supplementary teeth in a non-syndromic patients [J]. Med Arch, 2021, 75(1): 78-81. doi: 10.5455/medarh.2021.75.78-81.

[2] Cheng FC, Chen MH, Liu BL, et al . onsyndromic supernumerary teeth in patients in National Taiwan University Children´s hospital [J]. J Dent Sci, 2022, 17(4): 1612-1618. doi: 10.1016/j.jds.2022.07.015.

[3] Talaat DM, Hachim IY, Afifi MM, et al. Assessment of risk factors and molecular biomarkers in children with supernumerary teeth: a single-center study [J]. BMC Oral Health, 2022, 22(1): 117. doi: 10.1186/s12903-022-02151-z.

[4] Ma X, Jiang Y, Ge H, et al. Epidemiological, clinical, radiographic characterization of non-syndromic supernumerary teeth in Chinese children and adolescents [J]. Oral Dis, 2021, 27(4): 981-992. doi: 10.1111/odi.13628.

[5] Pescia R, Kiliaridis S, Antonarakis GS. Spontaneous eruption of impacted maxillary incisors after surgical extraction of supernumerary teeth: a systematic review and meta-analysis [J]. Clin Oral Invest, 2020, 24(11): 3749-3759. doi: 10.1007/s00784-020-03369-3.

[6] Hajmohammadi E, Najirad S, Mikaeili H, et al. Epidemiology of supernumerary teeth in 5000 radiography films: investigation of patients referring to the clinics of ardabil in 2015-2020 [J]. Int J Dent, 2021, 2021: 6669436. doi: 10.1155/2021/6669436.

[7] Si-Yeon, Park, Dds P, et al. Complications associated with specific characteristics of supernumerary teeth [J]. Oral Surg Oral Med Oral Pathol Oral Radiol, 2020, 130(2): 150-155. doi: 10.1016/j.oooo.2020.03.002.

[8] Nagata E, Nishiyama T, Yamashita M, et al. A primary canine and an impacted permanent canine with infection potentially induced an intracranial abscess[J]. Aust Dent J, 2020; 65(1): 96-9. doi: 10.1111/adj.12731.

[9] 束煌, 王骥, 陈婵婵, 等. 笑气联合咪达唑仑在儿童埋伏多生牙拔除术中的镇静效果 [J]. 口腔疾病防治, 2019, 27(5): 304-308. doi: 10.12016/j.issn.2096-1456.2019.05.006.

Shu H, Wang J, Chen CC, et al. Sedative efficacy of nitrous oxide

combined with midazolam in extraction of impacted supernumerary teeth in children [J]. J Prev Treat Stomatol Dis, 2019, 27(5): 304-308. doi: 10.12016/j.issn.2096-1456.2019.05.006.

[10] Jang DH, Chae YK, Lee KE, et al. Determination of the range of intervention timing for supernumerary teeth using the Korean health insurance review and assessment service database [J]. J Clin Pediatr Dent, 2023, 47(1): 67-73. doi: 10.22514/jocpd.2022.036.

[11] Chae YK, Lee H, Jih MK, et al. Validation of a three-dimensional printed model for training of surgical extraction of supernumerary teeth [J]. Eur J Dent Educ, 2020, 24(4): 637-643. doi: 10.1111/eje.12543.

[12] Lee H, Chae YK, Choi S, et al. Feasibility of a 3D surgical guide technique for impacted supernumerary tooth extraction: a pilot study with 3D printed simulation models [J]. Appl Sci, 2019, 9 (18): 3905. doi: 10.3390/app9183905.

[13] Zeng J, Jiang Y, Liu Y, et al. Research on a novel digital tooth sectioning guide system for tooth sectioning during mandibular third molar extraction: an *in vitro* study [J]. J Stomatol Oral Maxillofac Surg, 2023, 124(1): 101383. doi: 10.1016/j.jormas.2023.101383.

[14] Qu X, Zhen W, Ong HS, et al. Accuracy of computer-aided design/computer-aided manufacturing surgical template for guidance of dental implant distraction in mandibular reconstruction with free *Fibula* flaps [J]. J Craniofac Surg, 2020, 31(2): 355-359. doi: 10.1097/SCS.0000000000006112.

[15] Qi W, Qian J, Zhou W, et al. 3D-printed titanium surgical guides for extraction of horizontally impacted lower third molars[J]. Clin Oral Investig, 2023, 27(4): 1499-1507. doi: 10.1007/s00784-022-04769-3.

[16] Jo C, Bae D, Choi B, et al. Removal of supernumerary teeth utilizing a computer-aided design/computer-aided manufacturing surgical guide [J]. J Oral Maxillofac Surg, 2017, 75(5): 924.e1-924.e9. doi: 10.1016/j.joms.2016.11.002.

[17] Rai A, Jain A, Agrawal GD, et al. Non-syndromal multiple supernumerary and permanent impacted teeth in mother and her one child[J]. BMJ Case Rep, 2020;13(8). doi: 10.1136/bcr-2020-236395.

[18] Ghosh S, Dhungel S, Jaiswal B, et al. Multirooted supernumerary tooth in the anterior maxilla: a rare presentation[J]. Clin Case Rep, 2022, 10(7): e6101. doi: 10.1002/ccr3.6101.

[19] Granata S, Sforza NM, Giberti L, et al. Computer-guided implant surgery for immediate implanting and loading: the STIL technique [J]. J Prosthet Dent, 2021, 126(2): 155-163. doi: 10.1016/j.prosdent.2020.05.006.

[20] Moradinejad M, Hashemi Ashtiani A, Rakhshan V. Multiple non-syndromic unerupted supernumerary teeth: a report of a rare case [J]. Case Rep Dent, 2022, 2022: 4063856. doi: 10.1155/2022/4063856.

[21] Jiang Y, Ma X, Wu Y, et al. Epidemiological, clinical, and 3-dimentional CBCT radiographic characterizations of supernumerary teeth in a non-syndromic adult population: a single-institutional study from 60, 104 Chinese subjects [J]. Clin Oral Invest, 2020, 24 (12): 4271-4281. doi: 10.1007/s00784-020-03288-3.

[22] Song ZF, Fei F. Clinical study of the minimally invasive extraction of impacted supernumerary teeth in 85 cases [J]. J Prev Treat Stomatol Dis, 2020, 28(3): 169-173. doi: 10.12016/j.issn.2096-1456.2020.03.006.

[23] Dietrich T, Schmid I, Locher M, et al. Extraction force and its determinants for minimally invasive vertical tooth extraction [J]. J Mech Behav Biomed Mater, 2020, 105: 103711. doi: 10.1016/j.jmbbm.2020.103711.

[24] Liu J, Wang X, Shan P, et al. A randomized controlled trial: evaluation of efficiency and safety of a novel surgical guide in the extraction of deeply impacted supernumerary teeth in the anterior maxilla [J]. Ann Transl Med, 2022, 10(6): 292. doi: 10.21037/atm-22-585.

[25] Wang Z, Zhao SY, He WS, et al. Application of digital positioning guide plates for the surgical extraction of multiple impacted supernumerary teeth: a case report and review of literature [J]. World J Clin Cases, 2022, 10(27): 9886-9896. doi: 10.12998/wjcc.v10.i27.9886.

[26] Yu Y, Liao Y, Guo J, et al. Computer-designed surgical templates improve the extraction of impacted supernumerary teeth in the hard palate [J]. J Clin Pediatr Dent, 2022, 46(5): 38-43. doi: 10.22514/jocpd.2022.005.

[27] Zhu F, Hou D, Zhou C, et al. Precise extraction of impacted supernumerary tooth in the maxillary anterior region with a digital guide plate: a case report [J]. Medicine (Baltimore), 2022, 101(20): e29275. doi: 10.1097/MD.0000000000029275.

[28] Zheng X, Lin X, Zhang Z. Technical strategies for custom-made surgical guide in removal of impacted supernumerary mandibular premolars [J]. J Craniofac Surg, 2022, 33(7): e722-e723. doi: 10.1097/SCS.0000000000008634.

[29] Liu M, Yang X, Lv K, et al. Minimally-invasive alternative to the extraction of deeply-impacted supernumerary teeth using a computer-designed surgical template [J]. Br J Oral Maxillofac Surg, 2019, 57(3): 285-287. doi: 10.1016/j.bjoms.2019.01.013.

（编辑　罗燕鸿，曾曙光）

官网