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· 临床研究 ·

减数拔牙后正畸治疗中断情况下牙齿漂移的研究

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【摘要】 目的 比较不同类型患者减数拔牙后正畸治疗中断1.5月(45 d)后牙齿漂移的程度。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。选取已拔双侧前磨牙但因故未按时进行粘接托槽治疗的84例患者为研究对象。对患者的口腔上下颌模型进行三维扫描、重建和测量,根据患者的拔牙牙位(第一前磨牙或第二前磨牙)、颌骨类型(上颌或下颌)、垂直骨面型(均角、高角或低角)将其分为12组,应用多因素方差分析减数拔牙之后治疗中断1.5月情况下以下5项指标的变化,包括前牙拥挤度、尖牙间宽度、磨牙间宽度、拔牙间隙、前牙覆殆。**结果** 拔牙牙位、颌骨类型、垂直骨面型对减数拔牙后1.5个月拔牙间隙的减小量、前牙拥挤度的减小量有影响($P < 0.001$),拔牙牙位和垂直骨面型对前牙覆殆增加量有影响($P < 0.001$)。拔除第一前磨牙的患者相对于拔除第二前磨牙的患者双侧邻牙的漂移明显($P < 0.001$),上颌双侧邻牙漂移较下颌明显($P < 0.001$),高角的患者较均角及低角的患者双侧邻牙漂移量明显($P < 0.001$)。**结论** 对于正畸患者,如果存在上颌减数、第一前磨牙减数、垂直骨面型为高角的情况,拔牙双侧邻牙容易漂移,应该在减数拔牙后及时正畸治疗,并且注意支抗的控制。

【关键词】 生理性漂移; 口腔正畸学; 减数; 第一前磨牙; 第二前磨牙; 垂直骨面型; 数字化口内扫描; 三维成像

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Study of tooth drifts after orthodontic extractions in cases of interruption XING Jiahao¹, CHEN Hua², CHEN Min², CHEN Jindong¹, DOU Zhaojing¹, YANG Xin¹, JI Jun¹. 1. Department of Orthodontics, Nanjing Stomatological Hospital, Affiliated Hospital of Medical School, Nanjing University, Nanjing 210018, China; 2. Department of Stomatology, Taizhou Fourth People's Hospital, Taizhou 225300, China

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【Abstract】 Objective To compare the tooth drift differences between different types of patients after orthodontic extraction for 1.5 months (45 days) without return to the clinic on time for some reasons. **Methods** This study has been reviewed and approved by the Ethics Committee, and informed consent has been obtained from patients. A total of 84 patients had bilateral premolars extracted but were not bonded the bracket for some reasons. The upper and lower jaw dental models were cast, scanned, and reconstructed in 3D. Patients were divided into 12 groups based on extraction positions (first premolar or second premolar), jaw types (maxilla or mandible) and vertical facial types (average angle, high angle, or low angle). Multivariate analysis of variance was used to analyze the changes in the following five indicators in different types of patients who were interrupted for 1.5 months after extraction: anterior tooth crowding, width between canines, width between first molars, tooth extraction space, and overbite of anterior teeth. **Results** The tooth extraction position, jaw type and vertical facial type had an effect on the reduction in tooth extraction space and anterior tooth

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crowding before and after the sudden emergent state (1.5 months after tooth extraction) ($P < 0.001$), and the tooth extraction position and vertical facial type had an effect on the increase in anterior tooth overbite ($P < 0.001$). The drift of bilateral adjacent teeth was greater in patients with first premolars extracted than in those with second premolars extracted ($P < 0.001$), and the drift of bilateral adjacent teeth in the maxilla was larger than that of the mandible ($P < 0.001$). The drift of bilateral adjacent teeth in patients with high angles was more obvious than that of patients with average angles and low angles ($P < 0.001$). **Conclusion** For orthodontic patients who have maxillary tooth extraction, first premolar extraction, and even high angles in the vertical facial type, the bilateral adjacent teeth are easier to drift, orthodontic treatment should be carried out soon after extraction, and attention should be given to anchorage control.

【Key words】 physiological drift; orthodontics; tooth extraction; first premolar; second premolar; vertical facial type; digital intraoral scanning; 3D imaging

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牙齿漂移(driftodontics)是指牙齿拔除后,牙弓内其他牙齿自然的生理性移动,传统的正畸诊疗一般在拔牙后1~2周全口粘接固定矫治器,而亚历山大直丝弓矫治技术提倡拔除上下颌前磨牙后,先进行上颌的矫治,下颌待牙齿漂移一段时间后再纳入矫治。有学者使用方丝弓矫治技术进行相关研究,结果显示下颌牙齿漂移有利于正畸的诊疗^[1-2]。然而,同时探讨拔牙牙位、颌骨类型、垂直骨面型对牙齿漂移影响的研究未见报道。本研究对84例已经减数拔牙后,中断正畸治疗45 d的患者牙齿漂移进程中的多个影响因素进行了研究,以探讨其对牙齿漂移的影响。

1 资料和方法

1.1 研究对象

本研究经南京大学医学院附属口腔医院伦理审查委员会批准(审批号:KY-2021NL-062),所有研究对象均签署知情同意书。本研究选取84例2021年7月于南京大学医学院附属口腔医院就诊的、减数拔牙后由于患者原因正畸治疗中断1.5月,且为骨性I类错骀的患者为研究对象,其中男性38例,女性46例,年龄10~18岁,平均年龄(13.4±2.2)岁。

研究对象的纳入标准:①恒牙列,骨性I类错骀,拔除双侧前磨牙患者;②面部基本对称,无严重的颌面部发育畸形;③否认系统性疾病。研究对象的排除标准:①上下颌骨区域有外伤、手术史及病理损伤者;②患者牙体缺损过大或牙列缺损

等;③颌面部发育畸形者;④患有系统性疾病;⑤拔牙区邻牙牙髓活力异常,牙周根尖骨组织炎症。

1.2 材料与设备

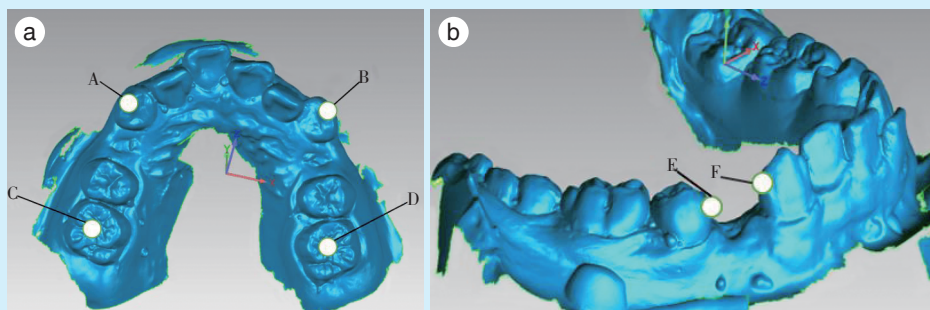
齿科藻酸盐印模材料(中山德尚伟业生物科技有限公司,中国);口内扫描仪(iTero, Align Technology,美国)。

1.3 研究方法

首先获取患者减数拔牙后,中断正畸治疗前后(未进行托槽粘接及其他治疗)的石膏模型,然后采用口内扫描仪对石膏模型进行扫描,获得数字化三维模型,再使用Geomagic Wrap 2017软件对数字化三维模型分析,确定三维模型的标志点后测量相关指标(图1)。所有测量项目均由同一测量者完成。1周后再重复测量第2次(经过一致性检验,Kappa值>0.75),取2次测量的平均值作为最后的测量结果。测量指标包括:①前牙拥挤度:前牙牙冠宽度的总和与牙弓现有弧形之长度之差;②尖牙间宽度:左右尖牙牙尖或牙尖磨耗面中点之间的距离;③第一磨牙间宽度:左右第一磨牙中央窝点隙间的距离;④拔牙间隙:拔牙牙位近中牙齿的远中最突点和拔牙牙位远中牙齿的近中最突点的距离;⑤前牙覆骀:牙尖交错骀时,上颌前牙盖过下颌前牙唇面间的垂直距离。

1.4 统计学分析

应用统计软件SPSS 22.0分析数据。本研究选取3个影响牙齿生理性漂移因素,即拔牙牙位(包括第一前磨牙、第二前磨牙)、颌骨类型(包括上颌



a: diagrammatic sketch of the measurements of the width between the canines and the central pits of the first molars, A & B: the cusps of the canines, C & D: the central pits of the first molars, the distance between A and B is the width between the canines, the distance between C and D is the width between the first molars; b: diagrammatic sketch of the measurement of extraction space, E: the mesial most protruding point of the distal tooth; F: the distal most protruding point of the mesial tooth, the distance between point E and F is the extraction space

Figure 1 Schematic diagram of digital 3D model landmark measurement of patients with interrupted orthodontic treatment after tooth extraction

图1 减数拔牙后正畸治疗中断患者数字化三维模型标志点测量示意图

骨、下颌骨)、垂直骨面型(包括高角面型、均角面型、低角面型)。将3个因素交叉组合,共得到12个组别。应用多因素方差分析正畸减数拔牙之后中断1.5月治疗患者不同的拔牙牙位、颌骨类型和垂直骨面型对前牙拥挤度、尖牙间宽度、第一磨牙间宽度、拔牙间隙、前牙覆殆5项指标变化的影响,采用单因素方差分析比较不同组间整体差异,经Levene's方差齐性检验,方差齐性者采用Bonferroni进行两两分析比较,若方差不齐者,采用Tamhane's T2进行两两分析比较,检测水准为双侧 $\alpha=0.05$ 。

2 结果

与患者刚拔牙减数时相比,中断治疗1.5个月,拔牙牙位、颌骨类型、垂直骨面型对拔牙间隙的减小量、前牙拥挤度的减小量有影响($P < 0.001$),而对尖牙间宽度的减小量、第一磨牙间宽度的减小量无明显影响($P > 0.05$),高角面型相较于均角和低角面型拔牙间隙的减小量、前牙拥挤度的减小量更大($P < 0.001$),上颌相较于下颌拔牙间隙的减小量、前牙拥挤度的减小量更大($P < 0.001$),拔除第一前磨牙的患者相较于拔除第二前磨牙的患者拔牙间隙的减小量、前牙拥挤度的减小量更大($P < 0.001$),具体数据见表1。

前牙覆殆在拔牙之后也发生了变化,拔牙牙位、颌骨类型、垂直骨面型对前牙覆殆的增加量有影响($P < 0.001$),高角的患者较均角、低角的患者前牙覆殆的增加量大($P < 0.001$),拔除第一前磨牙较拔除第二前磨牙的患者前牙覆殆增加量大($P <$

0.001),见表2。

3 讨论

口腔正畸诊疗是参照理想标准对错殆畸形进行个性化矫治的一项诊疗技术,其周期长,如正畸进程中中断,理论上会延长治疗周期、影响诊疗效果^[3-4]。有学者对正畸患者的牙齿漂移进行了研究,如Teng等^[5]对上颌拔除第一前磨牙6个月后的牙齿漂移进行了研究,发现漂移过程中上尖牙的远中直立移动使上前牙的拥挤缓解。应用多因素方差综合分析,不同拔牙牙位、颌骨类型及垂直骨面型正畸患者减数后未及时佩戴矫治器的患者前牙拥挤度、尖牙间宽度、第一磨牙间宽度、拔牙间隙、前牙覆殆5个指标变化情况,探究牙齿漂移的影响因素尚未见相关文献报道。

以往相应的研究的模型测量,有一些学者是利用直接测量法,采用游标卡尺、分规等,直接对石膏模型进行测量^[6-7]这种方法测量精度低、费时、费力,且石膏模型存在磨损、断裂、需要较大的储存空间、无法实现对实验数据的快速传输等问题。随着计算机图像技术的进步,利用数字化三维模型确定标志点并测量相关指标进行研究已经成为一种趋势,数字化三维模型可以在各个方向上进行旋转、放大及缩小,在三维重建软件中亦可对牙齿进行精确物理分割从而使牙齿近、远中接触点的辨认具有可重复性,较传统的模型测量拥有更高的精度^[8-9],有学者对比了传统石膏模型和数字化三维模型的精度和效率,结果显示数字化

表1 不同类型减数拔牙后正畸治疗中断患者牙齿漂移情况

Table 1 Tooth drift of different types of patients with interrupted orthodontic treatment after tooth extraction $\bar{x} \pm s$

Group	<i>n</i>	Reduction of tooth extraction space/mm	Reduction of width between canine teeth/mm	Reduction of width between first molars/mm	Reduction of anterior tooth crowding/mm
First premolar+maxillary+high angle	12	3.67 ± 0.56 (<i>P</i> < 0.001)	0.63 ± 0.34 (<i>P</i> = 3.216)	0.56 ± 0.12 (<i>P</i> = 0.925)	5.34 ± 0.67 (<i>P</i> < 0.001)
First premolar+maxillary+average angle	19	1.78 ± 0.95 (<i>P</i> < 0.001)	0.64 ± 0.52 (<i>P</i> = 2.158)	0.47 ± 0.08 (<i>P</i> = 1.088)	3.97 ± 0.35 (<i>P</i> < 0.001)
First premolar+maxillary+low angle	13	0.85 ± 0.73 (<i>P</i> < 0.001)	0.57 ± 0.12 (<i>P</i> = 0.864)	0.59 ± 0.16 (<i>P</i> = 0.347)	2.42 ± 0.22 (<i>P</i> < 0.001)
First premolar+mandible+high angle	12	2.05 ± 0.46 (<i>P</i> < 0.001)	0.46 ± 0.35 (<i>P</i> = 1.645)	0.54 ± 0.07 (<i>P</i> = 0.292)	4.04 ± 0.31 (<i>P</i> < 0.001)
First premolar+mandible+average angle	19	0.75 ± 0.38 (<i>P</i> < 0.001)	0.67 ± 0.17 (<i>P</i> = 2.537)	0.67 ± 0.08 (<i>P</i> = 1.451)	3.12 ± 0.25 (<i>P</i> < 0.001)
First premolar+mandible+low angle	13	0.32 ± 0.43 (<i>P</i> < 0.001)	0.32 ± 0.09 (<i>P</i> = 1.905)	0.49 ± 0.21 (<i>P</i> = 2.855)	2.01 ± 0.43 (<i>P</i> < 0.001)
Second premolar+maxillary+high angle	12	2.14 ± 0.53 (<i>P</i> < 0.001)	0.46 ± 0.21 (<i>P</i> = 0.837)	0.38 ± 0.12 (<i>P</i> = 3.097)	4.15 ± 0.36 (<i>P</i> < 0.001)
Second premolar+maxillary+average angle	14	0.71 ± 0.24 (<i>P</i> < 0.001)	0.56 ± 0.17 (<i>P</i> = 0.366)	0.45 ± 0.10 (<i>P</i> = 0.184)	2.87 ± 0.38 (<i>P</i> < 0.001)
Second premolar+maxillary+low angle	14	0.23 ± 0.08 (<i>P</i> < 0.001)	0.24 ± 0.07 (<i>P</i> = 3.228)	0.53 ± 0.07 (<i>P</i> = 1.098)	2.21 ± 0.47 (<i>P</i> < 0.001)
Second premolar+mandible+high angle	12	1.34 ± 0.15 (<i>P</i> < 0.001)	0.81 ± 0.15 (<i>P</i> = 0.836)	0.66 ± 0.04 (<i>P</i> = 0.656)	2.79 ± 0.44 (<i>P</i> < 0.001)
Second premolar+mandible+average angle	14	0.34 ± 0.07 (<i>P</i> < 0.001)	0.58 ± 0.11 (<i>P</i> = 0.285)	0.53 ± 0.11 (<i>P</i> = 0.765)	2.06 ± 0.42 (<i>P</i> < 0.001)
Second premolar+mandible+low angle	14	0.16 ± 0.02 (<i>P</i> < 0.001)	0.12 ± 0.03 (<i>P</i> = 0.143)	0.48 ± 0.12 (<i>P</i> = 0.569)	1.86 ± 0.21 (<i>P</i> < 0.001)

P value: immediate vs. 45 days after extraction (interruption of orthodontic treatment)

表2 不同类型减数拔牙后正畸治疗中断患者前牙覆骀的增加量

Table 2 Increase of anterior overbite in different types of patients with interrupted orthodontic treatment after tooth extraction $\bar{x} \pm s$

Group	<i>n</i>	Increase of anterior teeth overbite/mm
First premolar+high angle	12	0.59 ± 0.11 (<i>P</i> < 0.001)
First premolar+average angle	19	0.38 ± 0.10 (<i>P</i> < 0.001)
First premolar+low angle	13	0.22 ± 0.06 (<i>P</i> < 0.001)
Second premolar+high angle	12	0.41 ± 0.06 (<i>P</i> < 0.001)
Second premolar+average angle	14	0.18 ± 0.03 (<i>P</i> < 0.001)
Second premolar+low angle	14	0.10 ± 0.02 (<i>P</i> < 0.001)

P value: immediate vs. 45 days after extraction (interruption of orthodontic treatment)

三维模型更具优势^[10-11]。本研究采用数字化三维模型测量及定位,在此基础上,获得测量数据,运用多因素方差分析进行数据分析,探究不同类型患者的牙齿漂移情况及其相关指标的变化情况。

牙齿漂移是指牙齿拔除后,牙弓内其他牙齿自然的生理性移动,最早由 Bourdet 提出,也称生理性漂移。亚历山大直丝弓矫治技术提倡拔除4个第一前磨牙后,先进行上颌的矫治,下颌暂不矫治,待牙齿自然调整一段时间后再行固定矫治^[12]。目前利用余留牙的生理性漂移缓解拥挤、关闭间隙已获得认可。本研究结果显示,拔牙牙位、颌骨类型、垂直骨面型均会影响漂移的程度。另外,根据以往文献报道^[13],漂移的时间、患者的颌骨发育也可能对漂移的程度产生影响。

本研究结果显示上颌减数拔牙的患者较下颌减数的患者牙齿漂移更明显,这与秦飞等^[14]发现拔除上颌第一前磨牙后上颌牙齿漂移较下颌更明显结果相一致。分析原因,主要是上颌骨相较于

下颌骨骨质更为疏松,在牙列中份存在缺隙时,上颌牙齿更容易发生生理性漂移^[15]。另外,拔除第一前磨牙的患者较拔除第二前磨牙的患者牙齿漂移更明显。根据Omar等^[16]的研究,在拔除4颗前磨牙后,上下颌前牙的拥挤度均会减小,而拔除第二前磨牙的患者前牙拥挤度的减小量显著低于拔除第一前磨牙患者,这可能与第一前磨牙更接近前牙拥挤区有关。

有研究显示^[17-19],高角面型患者咀嚼肌力弱、颌骨骨密度低、牙弓偏窄,而低角面型患者咀嚼肌力强,颌骨骨密度高、牙弓偏宽,不同垂直骨面型患者的牙槽骨厚度存在差异:低角组最大,均角组次之,高角组最小,因此高角面型患者相对于均角、低角面型患者牙齿移动更明显。本研究结果显示高角面型患者拔牙后牙齿漂移较均角与低角的患者牙齿漂移更明显。

另外,Gragg等^[20]曾对下颌牙齿漂移前后前牙的覆殆变化进行了研究,结果显示前牙覆殆有加深的倾向,这与本研究结果一致,本研究结果显示高角较均角、低角面型前牙覆殆增加量大、提示高角患者牙齿漂移量更大。

研究表明,大部分生理性漂移发生在拔牙后的6~12个月,生理漂移的速度可能会随着时间的推移而减慢^[21-22]。Stephen等^[23]曾对拔除下颌第一前磨牙12个月后邻牙的漂移进行研究,发现在前2个月邻牙的漂移更为显著,2个月后牙齿漂移的速度明显减缓,漂移的平均速度在第3~12个月内基本保持稳定,这提示,随着时间的推移,牙齿的漂移速度会逐渐减缓。本研究发现减数1.5月后双侧拔牙间隙的减少量约在0.1~3.6 mm,与前期研究结果相一致,提示牙齿拔除后早期支抗控制的重要性。

综上,本研究显示上颌减数的患者较下颌减数的患者牙齿漂移更明显、拔除第一前磨牙的患者较拔除第二前磨牙的患者牙齿漂移更明显、高角的患者较均角与低角的患者牙齿漂移更明显,提示对于上颌减数的患者、拔除第一前磨牙的患者、高角的患者应更加关注支抗的控制。

【Author contributions】 Xing JH designed the study, collected, analyzed the data and wrote the article. Chen H, Chen M, Chen JD, Dou ZJ and Yang X designed the study, collected and measured the data. Ji J designed the study and revised the article. All authors read and approved the final manuscript as submitted.

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(编辑 周春华, 张晟)



官网

· 短讯 ·

《口腔疾病防治》被荷兰 Embase 数据库收录

近日,南方医科大学口腔医院主办的科技期刊《口腔疾病防治》经过严格的评选,被 Embase 数据库收录,现已正式上线并回溯至 2021 年文献。

Embase 是全球最大、最具权威性的生物医学与药理学文摘数据库,为荷兰《医学文摘》(Excerpta Medica)的在线版本,涵盖 1947 年以来累计超过 4400 万条生物医学记录,平均每天有超过 8000 条记录更新,收录了 95 个国家/地区入选的 8 300 多种期刊,据 Embase 官网收录期刊目录(2023-07-EMBASE-journals)显示,该数据库目前收录中国期刊 189 种,其中中文期刊 109 种。

这是继《口腔疾病防治》近年来被美国《乌利希期刊指南》(Ulrichsweb)、荷兰 Scopus、瑞典《开放获取期刊指南》(DOAJ)、WHO 西太平洋地区医学索引(WPRIM)、日本科学技术振兴机构数据库(JST)、瑞士《健康网络首创研究获取》(HINARI)、波兰《哥白尼索引》(IC)等多个国际重要数据库收录后入选的又一重要国际数据库。

这表明《口腔疾病防治》在主管主办单位的领导下和编委、审稿专家、广大作者、读者及社会各界的大力支持下,《口腔疾病防治》的国际影响力进一步提升,朝着高质量发展,为口腔医学领域广大的临床工作者和科技工作者提供了一个更广阔的国际学术交流平台,助力于双一流的建设和人类口腔健康。

《口腔疾病防治》编辑部