

[文章编号] 1671-587X(2025)04-1107-08

DOI:10.13481/j.1671-587X.20250427

正畸联合正颌治疗骨性Ⅱ类并发特发性髁突吸收 1 例报告 及文献复习

袁佳敏¹, 王宋庆^{1,2}, 吴聿森¹, 崔宇琛¹, 张琦¹, 朱宪春¹

(1. 吉林大学口腔医院正畸科, 吉林 长春 130021; 2. 河南省安阳市第六人民医院口腔正畸科,
河南 安阳 455000)

[摘 要] 骨性Ⅱ类高角患者常并发特发性髁突吸收 (ICR), 导致颞下颌关节功能障碍和颌面部畸形。本文报道 1 例骨性Ⅱ类高角并发 ICR 患者的诊疗过程。患者, 女性, 24 岁, 主诉前牙开骀及颞下颌关节疼痛, 经临床检查和影像学确诊为 ICR。采用骀板治疗稳定髁突吸收后, 实施正畸联合正颌治疗。治疗后 42 个月随访结果显示: 患者牙齿排列整齐, 散在间隙完全关闭, 前突面型明显改善 (ANB 角减少 4.2°), 颞下颌关节疼痛和弹响症状消失, 建立稳定的Ⅰ类咬合关系。三维 CT 复查显示髁突骨质重建良好, 关节间隙恢复正常。通过多学科联合治疗, 患者咬合功能和面部美观均获得明显改善。对于 ICR 患者应在髁突吸收稳定后实施正畸正颌联合治疗, 骀板治疗可作为有效的术前干预手段。

[关键词] 特发性髁突吸收; 骨性Ⅱ类错骀; 高角病例; 正畸正颌联合治疗; 骀板治疗; 颞下颌关节紊乱

[中图分类号] R783.5 **[文献标志码]** B

Orthodontic combined with orthognathic treatment of a Class Ⅱ malocclusion patient with idiopathic condylar resorption: A case report and literature review

YUAN Jiamin¹, WANG Songqing^{1,2}, WU Yumiao¹, CUI Yuchen¹, ZHANG Qi¹, ZHU Xianchun¹

(1. Department of Orthodontics, Stomatology Hospital, Jilin University, Changchun 130021, China;

2. Department of Orthodontics, Sixth People's Hospital, Anyang City, Henan Province,
Anyang 455000, China)

ABSTRACT The patients with skeletal Class Ⅱ high-angle malocclusion are frequently complicated by idiopathic condylar resorption (ICR), which may lead to temporomandibular joint (TMJ) dysfunction and dentofacial deformities. This article reports the diagnosis and treatment process of a 24-year-old female patient with skeletal Class Ⅱ high-angle malocclusion accompanied by ICR. The patient's chief complaints were anterior open bite and TMJ pain, and was diagnosed with ICR through clinical examination and imaging. After stabilizing condylar resorption with occlusal splint therapy, combined orthodontic-

[收稿日期] 2024-10-04 [录用日期] 2025-05-08

[基金项目] 吉林省科技厅自然科学基金项目 (YDZJ202201ZYTS057)

[作者简介] 袁佳敏 (1998—), 女, 河南省安阳市人, 在读硕士研究生, 主要从事口腔正畸学方面的研究。

[通信作者] 朱宪春, 副教授, 博士研究生导师 (E-mail: zhuxc@jlu.edu.cn)

©《吉林大学学报 (医学版)》编辑部, 开放获取遵循 CC BY-NC-ND 协议。

© Editorial Board of Journal of Jilin University (Medicine Edition). Open access under CC BY-NC-ND license.

orthognathic treatment was performed. The 42-month follow-up revealed: well-aligned dentition with complete closure of diastemas, significant improvement of protrusive facial profile (ANB angle reduced by 4.2°), complete resolution of TMJ pain and clicking, and establishment of stable Class I occlusion. Three-dimensional CT demonstrated satisfactory condylar bone remodeling and normalized joint space. Through multidisciplinary treatment, both occlusal function and facial aesthetics were significantly improved. This case demonstrates that orthodontic-orthognathic treatment should be performed after condylar stabilization in ICR patients, and occlusal splint therapy serves as an effective preoperative intervention.

KEYWORDS Idiopathic condylar resorption; Skeletal Class II malocclusion; High-angle case; Combined orthodontic-orthognathic treatment; Occlusal splint therapy; Temporomandibular joint disorders

特发性髁突吸收(idiopathic condylar resorption, ICR)又称为进行性髁突吸收或髁突萎缩,是一种以髁突表面骨皮质渐进性吸收为主要特征的罕见临床疾病,在正畸患者中的发病率为 $0.2\%\sim 0.7\%$ ^[1-2]。目前,ICR的病因尚不明确,可能与雌激素水平、系统性疾病、正颌手术、精神心理状态和外伤等多种因素有关^[3]。髁突渐进性吸收会导致下颌顺时针旋转、下颌后缩和前牙开骀,对患者的面容、口腔功能及健康产生较大影响。当髁突吸收严重时还会引起气道狭窄,出现继发性睡眠呼吸暂停^[4],进一步影响患者的生活质量。当ICR发生于青春期时,则会导致下颌骨生长发育障碍^[5],进而造成颜面畸形。ICR的治疗通常依据髁突吸收程度和阶段,采取保守治疗或手术治疗,保守治疗包括骀板治疗和药物治疗,手术治疗则包括关节盘复位术、人工颞下颌关节置换术和正畸正颌联合治疗等。针对ICR患者,国内外多使用骀板行保守治疗,对于髁突吸收严重者则选择关节盘置换手术,而关于正畸正颌联合治疗ICR的病例报道较少,且正畸治疗和正颌手术是否会诱导ICR复发尚存在一定争议。本文作者报道1例正畸正颌联合治疗骨性Ⅱ类高角伴ICR二次矫正患者的治疗过程,并进行文献复习,探讨该类患者诊断要点和正畸正颌联合治疗策略。

1 临床资料

1.1 一般资料 患者,女性,24岁,主诉咬合不稳伴嘴突,于2017年2月就诊于吉林大学口腔医院正畸科。现病史:5个月前出现双侧颞下颌关节(temporomandibular joint, TMJ)疼痛,伴玻璃碎片样弹响,经关节热敷后未见缓解。近5个月患者睡眠质量差,伴打鼾症状。自述头痛、耳鸣5月余。既往史:2年前于外院拔除14、24、34和44行

正畸治疗。否认系统性疾病、传染病史和家族遗传病史。矫正前曲面断层片显示:双侧髁突形态欠佳,前牙开骀(图1)。研究对象知情同意,本研究获得吉林大学伦理委员会审核通过(伦理审批号:2024年临审83号)。



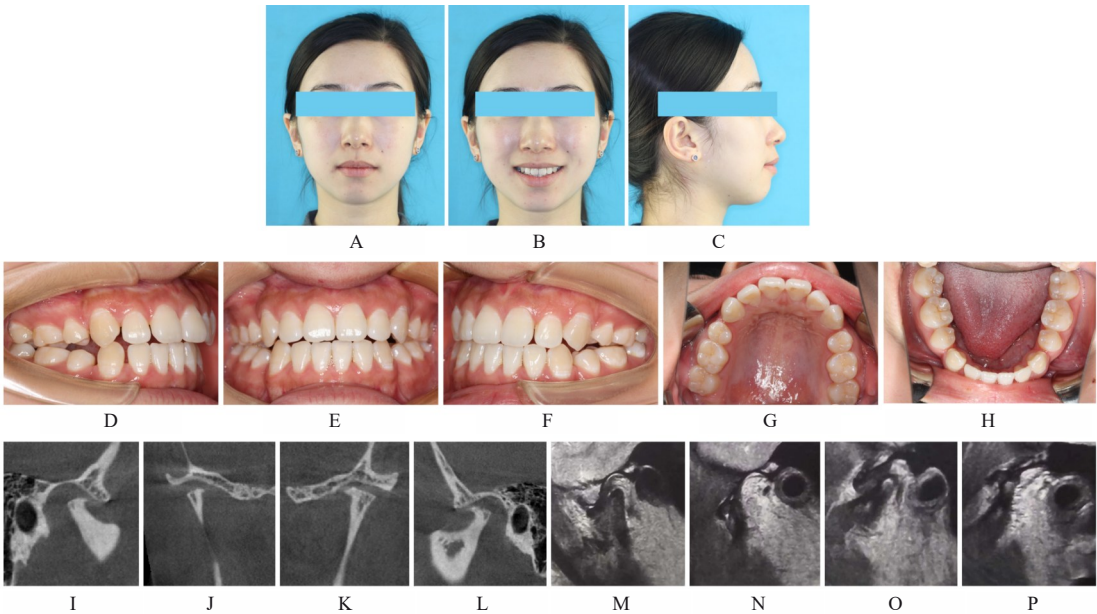
图1 骨性Ⅱ类并发ICR患者首次正畸治疗前曲面断层片

Fig. 1 Panoramic radiograph of patient with skeletal Class II accompanied by ICR before first orthodontic treatment

1.2 专科检查 面部检查:面部欠对称,颏点稍偏右,瞳孔连线左高右低,口角连线左低右高,患者面下1/3高度尚可,凸面型,鼻唇角 87° ,上下唇位于E线前。口内检查:恒牙列,14、24、34和44缺失,咬合关系不稳定,右侧尖牙和磨牙关系为远中关系,左侧尖牙和磨牙关系为基本中性,15、45、23、25、33和35开骀,上颌中线居中,下颌中线右偏1.5 mm,上下牙弓卵圆形;前牙浅覆骀浅覆盖,上颌4 mm散在间隙,下颌5 mm散在间隙,口腔卫生良好,唇和舌系带正常(图2A~图2H)。模型分析: Bolton指数中,前牙Bolton比:77.5%,全牙Bolton比:91.2%,Spee曲线深度1.5 mm。颞下颌关节检查:双侧TMJ弹响,咀嚼硬物时疼痛,开口度3.7 mm,开口型“↓”。影像学检查:锥体束CT(cone-beam CT,

CBCT) 显示双侧髁突呈鸟嘴状, 部分骨皮质不连续, 存在杯口状浅凹。核磁共振成像 (magnetic

resonance imaging, MRI) 显示双侧 TMJ 可复性关节盘前移位。见图 2I~图 2P。



A, B: Frontal view; C: Profile view; D—H: Intraoral images; I: Sagittal image of right TMJ on CBCT; J: Coronal image of right TMJ on CBCT; K: Coronal image of left TMJ on CBCT; L: Sagittal image of left TMJ on CBCT; M: MRI image of right TMJ at closed mouth; N: MRI image of right TMJ at open mouth; O: MRI image of left TMJ at closed mouth; P: MRI image of left TMJ at open mouth.

图2 骨性Ⅱ类并发ICR患者治疗前检查资料

Fig. 2 Pre-treatment clinical examination data of patient with skeletal Class II accompanied by ICR

1.3 诊断 ①特发性髁突吸收; ②安氏Ⅱ类错殆畸形; ③骨性Ⅱ类; ④毛氏Ⅱ⁵+Ⅳ²+Ⅰ²。

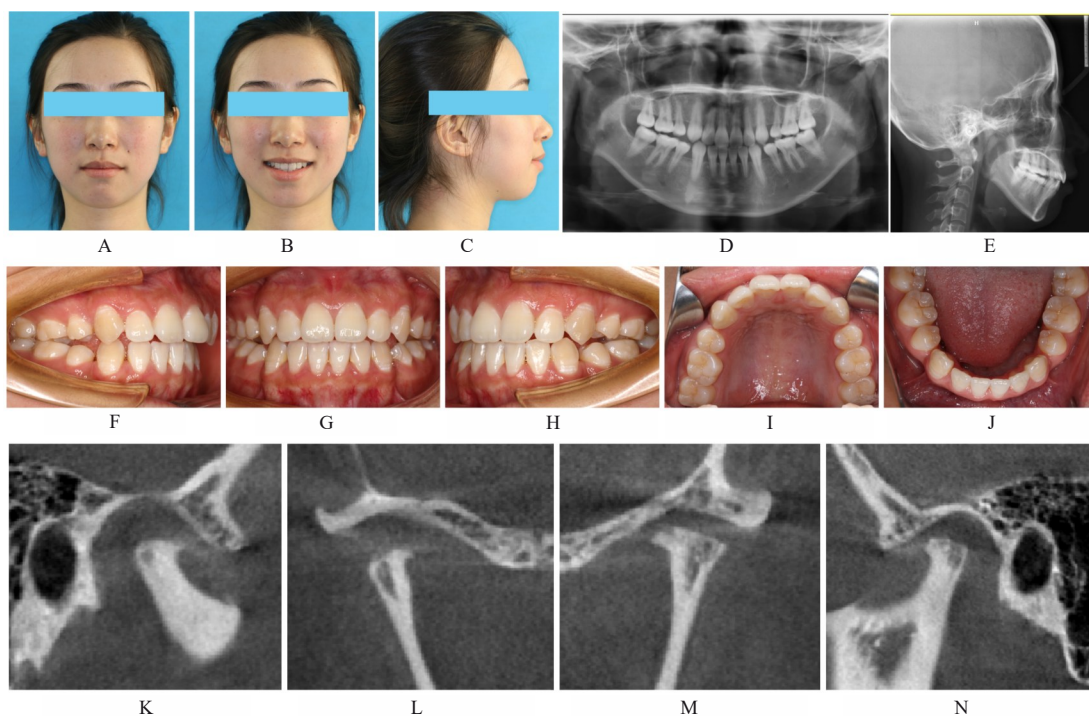
1.4 治疗目标 ①缓解患者疼痛, 稳定关节位置; ②排齐上下牙列, 关闭剩余间隙, 消除殆干扰, 建立健康稳定的咬合关系; ③改善骨骼关系, 恢复颜面协调美观。

1.5 治疗计划 转诊至颞下颌关节科, 行颞下颌关节骨关节病治疗, 待关节症状稳定后再制定正畸治疗方案。

1.6 治疗过程 在关节科佩戴6个月殆板后关节弹响和疼痛症状消失, 定期复查。殆板治疗半年后拍摄CBCT: 双侧髁突头平坦, 髁突形状呈鸟嘴状, 骨皮质未见明显变化, 双侧关节前间隙增宽, 关节后间隙减小。口内检查显示: 患者右侧尖牙、磨牙远中关系加重, 左侧尖牙和磨牙由基本中性演变为远中关系, 前牙覆盖增大, 水平开殆。曲面断层片显示: 14、18、24、28、34、38、44和48缺失, 上下颌前牙区牙周膜增宽, 前牙牙槽骨水平吸收至颈1/3, 双侧髁突形态欠佳(图3)。头影测量分析结果显示: 患者为骨性Ⅱ类骨面型(上齿槽座

角=7.1°), 高角型(下颌平面角=42.1°), 上颌中切长轴与SN平面交角=98.5°, 下中切牙长轴与下颌平面交角=82.2°。见表1。根据患者面像、口内像和X线片, 综合考虑患者面型、咬合、关节和气道等多方面因素, 与患者充分沟通后, 联合外科医生共同制定正畸正颌联合治疗方案, 方案: ①术前正畸。排齐整平上下颌牙列, 上颌磨牙前移关闭剩余间隙, 下颌强支抗内收前牙关闭间隙, 增大前牙覆盖, 协调上下颌牙弓宽度, 消除殆干扰。②正颌手术。上颌Le Fort I型截骨术+下颌骨矢状劈开前徙+颏成形+轮廓修整术。③术后正畸。精细调整咬合。④保持。⑤定期配合颞下颌关节复诊检查。

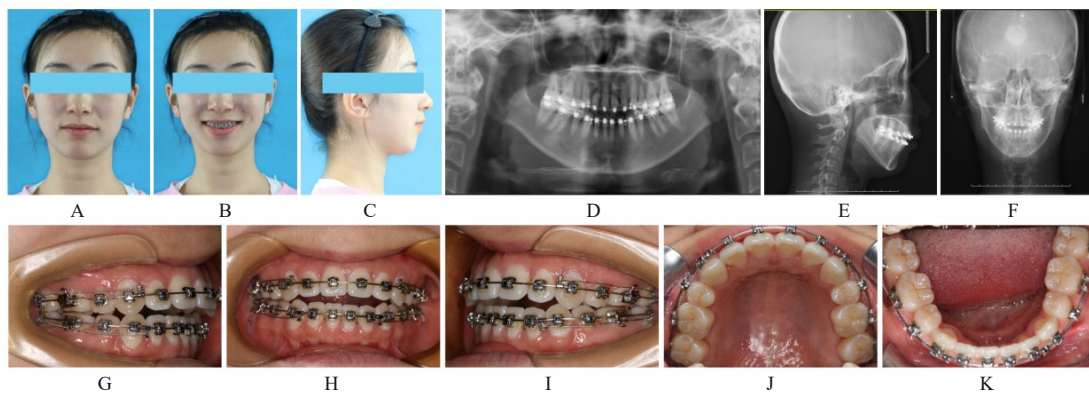
术前正畸(18个月): 上下颌依次使用0.014、0.016、0.016×0.022、0.018×0.025英寸(1英寸=2.54 cm)镍钛丝排齐上下颌牙列。0.018×0.025英寸钢丝进一步整平上下颌牙列, 关闭剩余散在间隙, 上颌前牙添加冠唇向转矩, 匹配牙弓宽度, 调整后牙转矩, 去除咬合干扰。治疗过程中轻力关闭间隙, 避免使用颌间牵引(图4)。



A, B: Frontal view; C: Profile view; D: Panoramic radiograph; E: Lateral radiograph; F—J: Intraoral images; K: Sagittal image of right TMJ on CBCT; L: Coronal image of right TMJ on CBCT; M: Coronal image of left TMJ on CBCT; N: Sagittal image of left TMJ on CBCT.

图3 骨性Ⅱ类并发ICR患者结束殆板治疗6个月后检查资料

Fig. 3 Clinical examination data of patient with skeletal Class II accompanied by ICR after splint therapy for six months



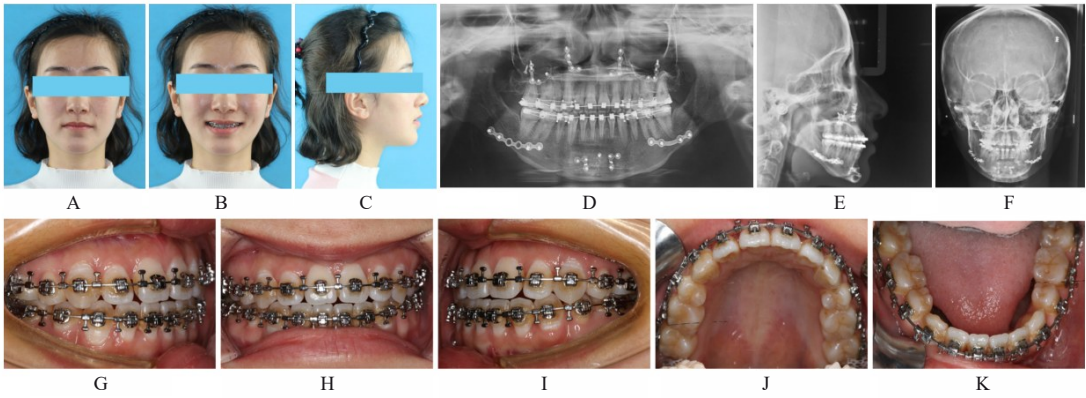
A, B: Frontal view; C: Profile view; D: Panoramic radiograph; E: Lateral radiograph; F: Posterior-anterior radiography; G—K: Intraoral images.

图4 骨性Ⅱ类并发ICR患者正颌术前检查资料

Fig. 4 Pre-orthognathic surgery clinical examination data of patient with skeletal Class II accompanied by ICR

正颌手术: 上颌 Le Fort I 型截骨术+下颌骨矢状劈开前徙+颏成形+轮廓修整术。术后正畸(12个月): 右侧短Ⅱ牵引, 左侧短Ⅲ类牵引调整下颌中线, 建立紧密咬合, 精细调整咬合关系(图5)。保持: 患者术后12个月咬合基本稳定, 拆除矫治器并制作上下颌哈雷保持器。

1.7 治疗结果 患者面部比例协调, 无明显偏斜, 唇和颏形态良好, 前突侧貌得到改善, 上下牙列排列整齐, 尖牙与磨牙基本中性, 前牙覆殆覆盖良好, 上下颌中线基本一致, 双侧TMJ无弹响疼痛。曲面断层片显示牙根平行度良好, 牙槽骨水平基本维持, 右侧髁突较矫正前有一定修复(图6)。



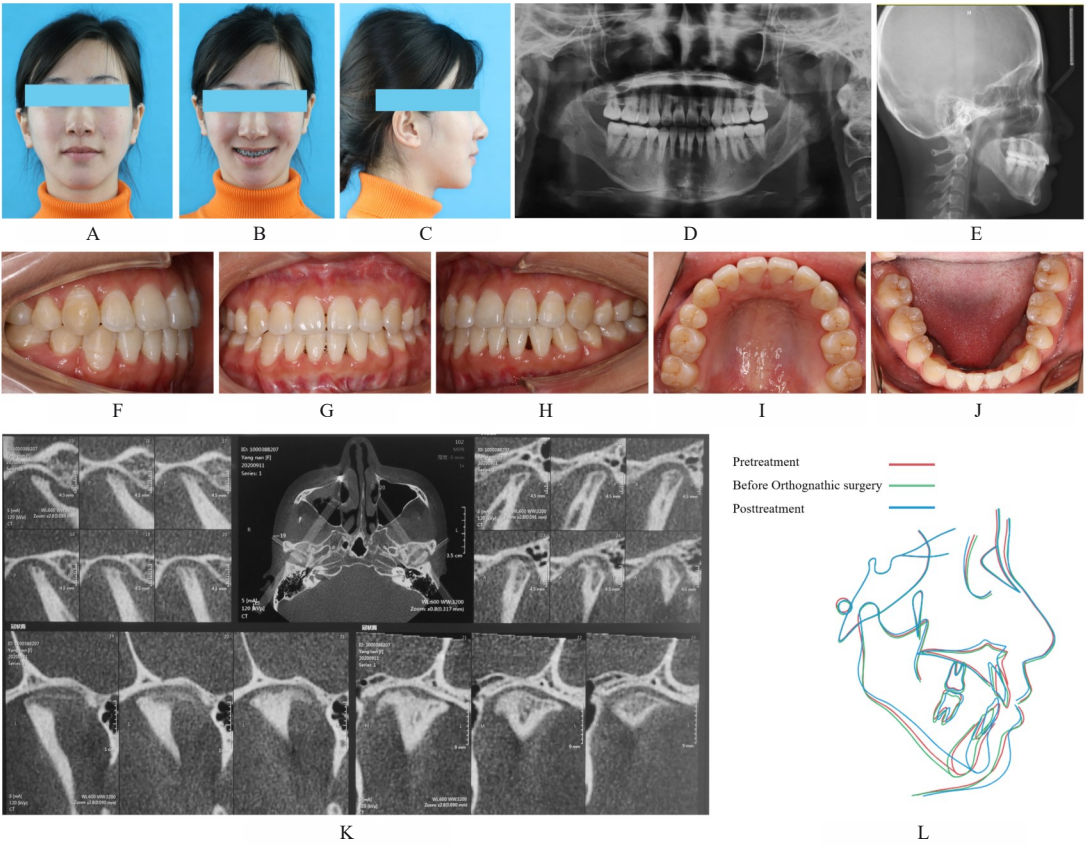
A,B: Frontal view; C: Profile view; D: Panoramic radiograph; E: Lateral radiograph; F: Posterior-anterior radiography; G—K: Intraoral images.

图5 骨性Ⅱ类并发ICR患者正颌术后检查资料

Fig. 5 Post-orthognathic surgery clinical examination data of patient with skeletal Class II accompanied by ICR

SNA、ANB 和 NA-APo 减小，上颌前突得到了有效改善。SNB 和 Go-Me 明显增大，表明下颌发生前移。FMA、MP-SN 和 OP-FH 减小，提示患者的下颌平面和殆平面发生了逆时针旋转，垂直骨面

型得到了改善（表1）。本病例在治疗后1年进行随访，患者尖牙和磨牙关系基本维持中性，咬合关系良好，下颌中线略右偏，TMJ 无弹响和压痛，术后情况基本稳定（图7）。



A,B: Frontal view; C: Profile view; D: Panoramic radiograph; E: Lateral radiograph; F—J: Intraoral images; K: Sagittal image of TMJ on CBCT; L: Superimposed tracings.

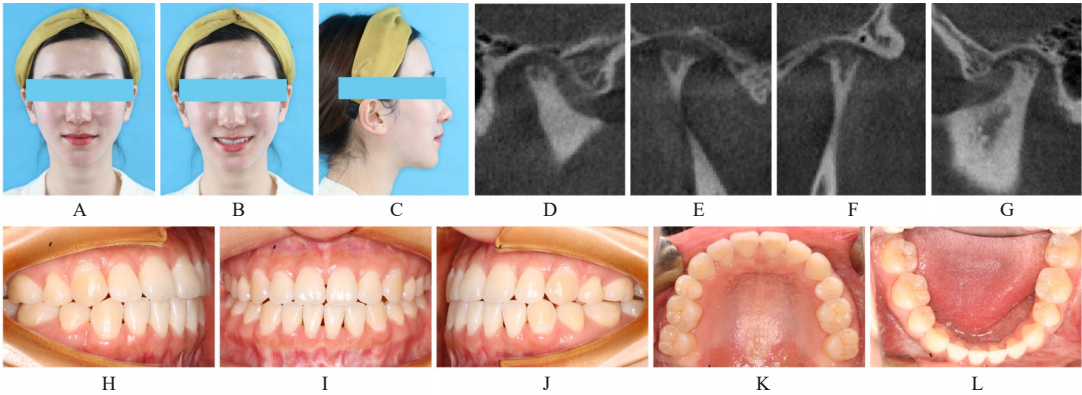
图6 骨性Ⅱ类并发ICR患者治疗结束时检查资料

Fig. 6 Clinical examination data of patient with skeletal Class II accompanied by ICR after treatment

表 1 骨性Ⅱ类并发 ICR 患者治疗前、中和后头影测量值

Tab.1 Cephalometric measurement values of patient with skeletal Class Ⅱ accompanied by ICR before, during, and after treatment

Measurement index	Normal value	Pre-treatment	Before orthognathic operation	After orthognathic operation	Post-treatment
SNA(°)	83.0±4.0	84.9	82.2	79.8	80.1
SNB(°)	80.0±4.0	76.8	74.7	77.7	77.8
ANB(°)	3.0±2.0	7.1	7.5	2.1	2.2
FMA(°)	27.3±6.1	42.1	44.4	38.4	38.5
MP-SN(°)	30.5±5.6	51.0	52.7	46.2	45.8
Go-Me(mm)	71.0±5.0	63.4	63.4	72.2	70.0
OP-FH(°)	9.3±3.8	21.0	19.5	14.4	15.3
NA-APo(°)	6.5±4.5	17.9	12.9	1.7	4.5
N-Me(mm)	112.0±7.0	106.9	105.3	106.0	106.9
ANS-Me(mm)	61.0±3.0	57.2	57.6	59.5	59.9
ANS-Me/Na-Me(%)	55.0±3.0	53.5	54.7	56.2	56.0
U1-NA(°)	5.0±2.0	1.3	0.1	3.6	5.0
U1-SN(°)	106.0±6.0	98.5	107.9	107.0	107.5
L1-NB(mm)	7.0±2.0	7.5	5.6	4.0	4.5
L1-MP(°)	93.9±6.2	82.2	87.0	86.2	82.7
U1-L1(°)	124.0±8.0	127.0	125.3	130.3	127.8



A, B: Frontal view; C: Profile view; D: Sagittal image of right TMJ on CBCT; E: Coronal image of the right TMJ on CBCT; F: Coronal image of left TMJ on CBCT; G: Sagittal image of left TMJ on CBCT; H—L: Intraoral images.

图 7 骨性Ⅱ类并发 ICR 患者治疗 1 年后随访检查资料

Fig. 7 Clinical examination data of patient with skeletal Class Ⅱ accompanied by ICR after treated for one year

2 讨论

ICR 的病因尚不明确，可能与雌激素水平、TMJ 负荷改变和关节适应改建能力下降等因素有关^[6-7]，常见于 15~35 岁女性，男女发病比例约为 1:9^[8]。根据疾病的活动性和髁突吸收程度等因素分为软组织期、活动期和稳定期^[9]。该病的诊断主要依靠病史、临床检查和影像学分析。患者通常以“进行性下颌后缩”为主诉就诊，多数伴有上颌前突、下颌后缩、下颌升支高度降低及后前面高比例

降低，口内主要表现为安氏Ⅱ类错殆畸形，前牙开殆，伴或不伴有关节区疼痛，可发生于单侧或双侧，当发生在单侧时主要表现为下颌及下颌中线偏向患侧，后牙反殆及早接触^[10]。曲面断层片可见髁突形状欠佳，骨皮质不连续。头颅侧位片通常表现为骨性Ⅱ类高角，下颌升支高度降低，严重者可伴有气道狭窄。CBCT 是诊断 ICR 的全面且有效的重要手段，主要表现为髁突体积和表面积减少，其三维重建功能可直观地观察到髁突吸收部位和程

度^[11-12],当骨皮质表面出现不连续或存在杯口状缺损时提示患者可能处于ICR的活动期。ICR患者通常伴随长期的关节盘前移位^[13],MRI检查可以清楚地判断盘-髁位置关系,观察关节盘损伤情况,是观察TMJ软组织的首选检查方法。放射性核素锝-亚甲基二磷酸盐(technetium-^{99m}methylene diphosphonate, ^{99m}TC-MDP)可较为精准地判断髁突吸收是否处于活动期^[14],但其辐射剂量较高,存在一定的局限性。

该患者正颌治疗前的曲面断层片显示:髁突形状欠佳,体积减小,髁突表面扁平,前牙开殆且无切端发育结节,提示患者在ICR发病前前牙曾存在咬合接触。就诊时患者咬合不稳定,双侧TMJ存在弹响和疼痛症状,CBCT显示髁突形状呈鸟嘴状,体积减小,骨皮质表面连续性破坏。髁突位置和功能稳定是保证正颌治疗效果稳定的基础,在骨皮质破坏阶段,TMJ适应改建能力下降,此时进行正颌治疗可能会加重关节区负荷,进而加速髁突吸收进程。髁突位置的不稳定还可能对矫正效果产生不利影响。因此,在正颌治疗前应先进行全面的关节检查和治疗,以确保髁突位置的准确性和稳定性。研究^[15]显示:ICR的进展速度为每年1.0~1.5 mm,在开始正颌治疗前需通过连续的临床监测及影像学检查,至少观察1年以确定髁突吸收稳定性。稳定性殆板作为ICR患者活动期常用治疗方式之一,有助于稳定盘-髁位置关系,缓解肌张力,减小关节腔压力^[16],判断疾病活动性并准确定位下颌位置,为髁突改建创造有利环境^[17]。该患者经过殆板治疗后关节弹响和疼痛症状消失,对患者关节状态进行再次评估,双侧关节结节和关节窝等未见明显骨质增生及破坏,髁突吸收基本稳定,但Ⅱ类面型进一步恶化,遂开始正颌正颌联合治疗。

ICR与正颌治疗的关系尚不明确,部分学者^[18-19]认为正颌治疗与颞下颌关节紊乱病(temporomandibular disorders, TMD)无关。研究^[20]显示:ICR患者在活动期时,TMJ适应改建能力降低,易受到生物力的影响,此时正颌治疗可能会加重原有关节吸收症状,而在ICR稳定期,规范的正颌治疗对TMD具有辅助康复作用^[21]。在ICR稳定期应尽快去除病理性殆因素,消除殆干扰,减少对神经肌肉的异常刺激;避免使用颌间牵引^[10, 22],以防止引起髁突位置改变及后牙伸长,对TMJ产生不必要的负荷。

19%~31%的Ⅱ类高角患者在正颌术后出现髁突吸收^[22]。有学者^[15]认为:正颌手术后由于肌肉牵拉前伸的下颌骨,髁突在关节窝内重新定位,发生向后移位和逆时针旋转,髁突内表面和前上方由于关节腔压力增加超过TMJ适应改建能力导致吸收。但也有学者^[23]认为:术后复发是由于髁突在关节窝内位置不稳定所引起,在正颌正颌联合治疗前通过殆板稳定髁突位置,能有效降低正颌术后复发可能。MERCURI等^[24]认为:20岁后髁突吸收逐渐趋于停止,此时正颌手术有助于降低髁突吸收的发生率。GUNSON等^[25]提出:在正颌手术前后服用抗炎药、维生素D和钙补充剂可以抑制或减缓术后髁突吸收。对于术前已经存在髁突吸收的患者,限制下颌前移在5 mm内也可降低术后髁突吸收风险^[26]。

综上所述,ICR临床诊断需综合考量患者的病史、临床表现和影像学资料。对于骨性Ⅱ类高角青春期患者,早期拍摄CBCT至关重要,旨在明确髁突位置及骨皮质表面稳定性,排除ICR后制定后续治疗方案。对于髁突正在吸收的患者,应尽快停止正颌治疗,待症状缓解后再行正颌治疗。正颌正颌联合治疗骨性Ⅱ类伴ICR不仅能实现稳定的疗效,还能促进颜面协调美观。

利益冲突声明:

所有作者声明不存在利益冲突

作者贡献声明:

袁佳敏参与资料收集、论文撰写和修改,王宋庆参与病例治疗、资料分析和讨论,吴聿森参与患者临床诊断和治疗,崔宇琛和张琦参与数据收集,朱宪春参与治疗方案制定、操作指导和论文审阅。

[参考文献]

- [1] HANDELMAN C S, GREENE C S. Progressive/idiopathic condylar resorption: an orthodontic perspective[J]. *Semin Orthod*, 2013, 19(2): 55-70.
- [2] NOBREGA M T C, ALMEIDA F T, FRIESEN R, et al. Idiopathic condylar resorption in adolescents: a scoping review[J]. *J Oral Rehabil*, 2024, 51(8): 1610-1620.
- [3] WOLFORD L M, GONÇALVES J R. Condylar resorption of the temporomandibular joint: how do we treat it? [J]. *Oral Maxillofac Surg Clin North Am*, 2015, 27(1): 47-67.
- [4] POSNICK J C, FANTUZZO J J. Idiopathic condylar

- resorption: current clinical perspectives [J]. *J Oral Maxillofac Surg*, 2007, 65(8): 1617-1623.
- [5] EXPOSTO C R, STOUSTRUP P, KRISTENSEN K D, et al. Condylar changes in patients with idiopathic condylar resorption: retrospective 2-year follow-up CBCT-based case-control study [J]. *Eur J Orthod*, 2020, 42(6): 619-625.
- [6] 徐 凡, 周 青. 下颌骨特发性髁突吸收的认识和争议[J]. *口腔医学研究*, 2019, 35(5): 430-432.
- [7] JI Y D, RESNICK C M, PEACOCK Z S. Idiopathic condylar resorption: a systematic review of etiology and management [J]. *Oral Surg Oral Med Oral Pathol Oral Radiol*, 2020, 130(6): 632-639.
- [8] WOLFORD L M. Idiopathic condylar resorption of the temporomandibular joint in teenage girls (cheerleaders syndrome)[J]. *Proc (Bayl Univ Med Cent)*, 2001, 14(3): 246-252.
- [9] HATCHER D C. Progressive condylar resorption: pathologic processes and imaging considerations [J]. *Semin Orthod*, 2013, 19(2): 97-105.
- [10] RIECHMANN M, SCHMIDT C, AHLERS M O, et al. Controversial aspects of diagnostics and therapy of idiopathic condylar resorption: an analysis of evidence- and consensus-based recommendations based on an interdisciplinary guideline project [J]. *J Clin Med*, 2023, 12(15): 4946.
- [11] YOUNG A. Idiopathic condylar resorption: The current understanding in diagnosis and treatment [J]. *J Indian Prosthodont Soc*, 2017, 17(2): 128-135.
- [12] TANAKA E, MERCURI L G. Current status of the management of idiopathic condylar resorption/progressive condylar resorption-a scoping review [J]. *J Clin Med*, 2024, 13(13): 3951.
- [13] SHEN P, ZHANG D H, LUO Y, et al. Characteristics of patients with temporomandibular joint idiopathic condylar resorption [J]. *Cranio*, 2025, 43(1): 151-157.
- [14] SANSARE K, RAGHAV M, MALLYA S M, et al. Management-related outcomes and radiographic findings of idiopathic condylar resorption: a systematic review [J]. *Int J Oral Maxillofac Surg*, 2015, 44(2): 209-216.
- [15] CHIGURUPATI R, MEHRA P. Surgical management of idiopathic condylar resorption: orthognathic surgery versus temporomandibular total joint replacement [J]. *Oral Maxillofac Surg Clin North Am*, 2018, 30(3): 355-367.
- [16] ZHOU J L, FU Y J, YU L X, et al. A novel three-dimensional morphological analysis of idiopathic condylar resorption following stabilisation splint treatment [J]. *J Oral Rehabil*, 2021, 48(5): 560-567.
- [17] LEE G H, PARK J H, LEE S M, et al. Orthodontic treatment protocols for patients with idiopathic condylar resorption [J]. *J Clin Pediatr Dent*, 2019, 43(4): 292-303.
- [18] GIRAY B, SADRY S. Modifications in Class I and Class II Div. 1 malocclusion during orthodontic treatment and their association with TMD problems [J]. *Cranio*, 2021, 39(1): 65-73.
- [19] SHALISH M, LEIBOVICH A, ZAKUTO A, et al. The association between orthodontic treatment and temporomandibular disorders diagnosis and disease characteristics [J]. *J Oral Rehabil*, 2024, 51(3): 487-499.
- [20] IWASA A, TANAKA E. Signs, symptoms, and morphological features of idiopathic condylar resorption in orthodontic patients: a survey-based study [J]. *J Clin Med*, 2022, 11(6): 1552.
- [21] 赵 宁, 房 兵. 正畸治疗与颞下颌关节紊乱病的研究进展 [J]. *口腔医学*, 2024, 44(1): 20-23.
- [22] LEE G H, PARK J H, PARK Y G, et al. Orthodontic treatment of an open bite after splint therapy for a patient with idiopathic condylar resorption [J]. *J World Fed Orthod*, 2024, 13(1): 38-47.
- [23] HA N, HONG Y Y, QU L Y, et al. Evaluation of post-surgical stability in skeletal class II patients with idiopathic condylar resorption treated with functional splint therapy [J]. *J Craniomaxillofac Surg*, 2020, 48(3): 203-210.
- [24] MERCURI L G, HANDELMAN C S. Idiopathic condylar resorption: what should we do? [J]. *Oral Maxillofac Surg Clin North Am*, 2020, 32(1): 105-116.
- [25] GUNSON M J, ARNETT G W, MILAM S B. Pathophysiology and pharmacologic control of osseous mandibular condylar resorption [J]. *J Oral Maxillofac Surg*, 2012, 70(8): 1918-1934.
- [26] WANG J, VEISZENBACHER E, WAITE P D, et al. Comprehensive treatment approach for bilateral idiopathic condylar resorption and anterior open bite with customized lingual braces and total joint prostheses [J]. *Am J Orthod Dentofacial Orthop*, 2019, 156(1): 125-136.