

临床论著

色努支具治疗青少年特发性脊柱侧凸
的疗效及影响因素分析边 臻¹, 郭 源¹, 傅 刚¹, 杨 征¹, 吕学敏¹, 朱振华¹, 肖 斌²

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【摘要】目的:观察色努支具治疗青少年特发性脊柱侧凸的疗效,探究影响疗效的相关因素。**方法:**2016 年 1 月~2018 年 6 月采用色努支具治疗的青少年特发性脊柱侧凸患者 49 例,其中女性 46 例,男性 3 例,治疗初始年龄 12.6 ± 1.3 岁(10~15 岁),初始主弯 Cobb 角 $32.5^\circ\pm 6.9^\circ$ ($20^\circ\sim 45^\circ$),初始 Risser 征 2.2 ± 1.6 。收集患者的临床资料:年龄、每日佩戴时间等信息;影像学资料:初始、佩戴支具即刻和随访的系列脊柱全长 X 线片。通过佩戴支具即刻 X 线片计算初始支具矫正率。评估治疗后结果:Cobb 角减少 $\geq 6^\circ$ 定义为“改善”,Cobb 角变化 5° 以内定义为“稳定”,Cobb 角增大 $\geq 6^\circ$ 定义为“进展”,前两者为治疗成功。观察初始支具矫正率在各组结果中的差异;分析畸形进展的患者相关因素:畸形严重程度($20^\circ\sim 29^\circ$, $30^\circ\sim 39^\circ$ 及 $40^\circ\sim 45^\circ$ 三组)、Risser 征(0~4)和侧凸类型(胸弯、胸腰弯/腰弯、双主弯三种类型);并分析影响初始支具矫正率的可能因素。**结果:**49 例患者平均治疗 2.0 ± 1.0 年,所有患儿每天支具佩戴时间在 18~20h 以上,依从性良好。随访 2.0 ± 1.0 年(1~5 年),末次随访时年龄 14.6 ± 1.4 岁,Risser 征 4.2 ± 0.6 ,末次随访 Cobb 角 $28.5^\circ\pm 9.6^\circ$;其中畸形改善 31 例,畸形稳定 14 例,支具治疗的总体成功率为 91.8%(45/49);畸形进展 4 例,其中 3 例畸形超过 45° 。初始支具矫正率平均 $(64.9\pm 23.6)\%$,其在改善组、稳定组和进展组分别为 $(69.5\pm 23.2)\%$ 、 $(61.5\pm 23.7)\%$ 和 $(42.5\pm 10.0)\%$,初始支具矫正率和各组结果存在中等强度相关性(相关系数 0.318, $P=0.026$);有序多分类 Logistic 回归显示支具矫正率对结果存在正向影响,差异有统计学意义($P=0.045$)。分析畸形进展的患者相关因素发现:畸形严重和骨骼成熟度低是畸形进展的危险因素($P=0.016$ 和 $P=0.010$),不同侧凸类型的畸形进展率没有统计学差异($P=0.124$),但 4 例进展患儿均发生在胸段侧凸(3 例胸弯,1 例双主弯),胸腰弯/腰弯无进展病例。多因素分析显示,畸形程度越低,初始支具矫正率越高($P=0.001$);侧凸类型和 Risser 征对矫正率无显著影响($P>0.05$)。**结论:**色努支具是治疗青少年特发性脊柱侧凸的有效方法,初始支具矫正率是影响结果的重要因素,初始支具矫正率越高治疗效果越优;畸形程度严重($>40^\circ$)和骨骼成熟度低(Risser 0)的胸段侧凸患儿,畸形进展的可能性更大。

【关键词】 青少年特发性脊柱侧凸;支具治疗;初始支具矫正率

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Observation on the curative effect and analysis of influencing factors of Cheneau brace in the treatment of adolescent idiopathic scoliosis/BIAN Zhen, GUO Yuan, FU Gang, et al//Chinese Journal of Spine and Spinal Cord, 2022, 32(6): 496-502

【Abstract】Objectives: To study the efficacy of Cheneau brace in the treatment of adolescent idiopathic scoliosis and investigate the related factors affecting the outcomes. **Methods:** Patients diagnosed with adolescent idiopathic scoliosis(AIS) and treated with Cheneau brace from January 2016 to June 2018 were reviewed. 49 patients(46 females and 3 males) were included in the study. The average initial treatment age was 12.6 ± 1.3 y (10-15y), the initial Risser sign was 2.2 ± 1.6 , and the initial main curve Cobb angle was $32.5^\circ\pm 6.9^\circ$ ($20^\circ\sim 45^\circ$). The clinical data including age and daily wearing time and radiological data of full-length X-ray films of

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spine at the beginning, immediately after bracing and follow-up were evaluated. In-brace correction was calculated using immediate X-ray film after bracing. The outcomes were evaluated as "improved" (reduction of Cobb angle $\geq 6^\circ$), "stable unchanged" (Progression or reduction of Cobb angle within 5°), and "worsened" (Cobb angle $\geq 6^\circ$ progression), and the outcomes of "improved" and "stable" were considered as successful. The influencing factors for deformity progress were analyzed, including treatment factor of in-brace correction and patients' factors, such as deformity magnitude(20° – 29° , 30° – 39° and 40° – 45°), Risser sign (0–4), and curve type (thoracic curve, thoracolumbar/lumbar curve, and double major curve). Meanwhile, the potential factors affecting the in-brace correction rate were also analyzed. **Results:** Of all the patients, the average treatment duration was 2.0 ± 1.0 years. All children wore braces for more than 18–20 hours per day, with good compliance. The average age of patients in the last follow-up was 14.6 ± 1.4 years, the Risser sign was 4.2 ± 0.6 , and the Cobb angle was $28.5^\circ \pm 9.6^\circ$. Deformity improved in 31 cases, deformity unchanged in 14 patients, and the successful rate was 91.8%(45/49). Deformity progressed in 4 cases, of which 3 cases were more than 45° . The average In-brace correction was $(64.9 \pm 23.6)\%$, which was $(69.5 \pm 23.2)\%$, $(61.5 \pm 23.7)\%$ and $(42.5 \pm 10.0)\%$ in the improved group, the stable group and the worsened group, respectively. There was a moderate correlation between the initial orthosis rate and the results of each group (correlation coefficient 0.318, $P=0.026$); Ordinal multinomial logistic regression showed that the brace correction rate had a positive effect on the results, and the difference was statistically significant($P=0.045$). By analyzing the patients' factors for deformity progression, it was found that deformity magnitude and bone maturity were risk factors for deformity progression ($P=0.016$ and $P=0.010$). There was no significant difference in the rate of deformity progression among different curve types($P=0.124$). However, the 4 cases of progressive deformity all occurred in thoracic region (3 cases of thoracic curve and 1 case of double major curve), no progress occurred in thoracolumbar curve/lumbar curve. Multivariate analysis showed that the lower the degree of deformity, the higher in-brace correction ($P=0.001$); the curve type and Risser score had no significant effect on in-brace correction. **Conclusions:** Cheneau brace serves as an effective method for the treatment of adolescent idiopathic scoliosis. In-brace correction rate is an important factor affecting the outcomes, that is the higher the in-brace correction rate, the better the treatment results. Thoracic region curve with severe deformity ($> 40^\circ$) and low level of skeletal maturity(Risser 0) are more likely to progress.

[Key words] Adolescent idiopathic scoliosis; Brace treatment; In-brace correction

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青少年特发性脊柱侧凸(adolescent idiopathic scoliosis, AIS) 在 10~16 岁青少年人群的发病率为 1%~3%, 女性更多见, 其特点是随着青春期内患儿身高的增长, 畸形会逐渐进展, 畸形严重会影响患者的身心健康^[1,2]。对于畸形程度超过 20° ~ 25° 的患儿, 一般采用支具治疗为主的保守治疗; 若畸形进展到 45° 以上需采取融合手术治疗^[3]。

目前支具治疗可以有效控制畸形进展, 延缓 AIS 进展的自然病程, 降低外科手术干预程度。然而不同的支具治疗方法, 临床疗效存在一定的差异, 文献报道支具治疗后仍需手术干预的发生率在 0~43% 之间^[4,5]。影响支具治疗结果的因素主要包括: 每天佩戴时间、初始支具矫正率、骨骼成熟度、畸形严重程度、侧凸类型及支具类型等^[6,7]。

本研究回顾我院采用色努支具保守治疗的

AIS 患儿, 观察支具治疗的临床效果, 旨在观察畸形程度是否得到有效控制, 而避免行外科矫形融合手术(成功率); 同时统计多少患者可以通过支具治疗达到畸形部分的矫正(改善率), 并分析影响其结果的相关因素。

1 资料和方法

1.1 纳入和排除标准

纳入标准: (1) 诊断为 AIS, 年龄大于 10 岁; (2) 既往无手术及支具治疗史; (3) 骨骼未成熟, Risser 征 ≤ 4 ; (4) Cobb 角介于 20° ~ 45° , 并采用色努支具治疗。排除标准: (1) 先天性及综合征性脊柱侧凸: 如神经纤维瘤病、神经肌肉疾病、先天性及综合征性脊柱侧凸等; (2) 随访时间 < 1 年。

1.2 诊疗方法和资料收集

门诊确诊为 AIS, 对于 Cobb 角 $20^{\circ}\sim 45^{\circ}$, 骨骼未成熟的患者给予色努支具治疗。佩戴支具后即刻拍摄 X 线片。同时拍摄左手及手腕 X 线片, 通过观察指骨及尺桡骨远端骨骺形态, 辅助判断患儿的骨龄^[8]。支具要求全天佩戴 (每天佩戴 20~22h), 并结合腰背肌力量锻炼等物理治疗, 鼓励患儿做跑步及游泳锻炼。每 4~6 个月复查, 记录畸形变化, 根据生长情况, 半年或一年更换支具, 骨骼成熟后停止支具治疗。判断骨骼成熟依据: 初潮后 3 年; Risser 征 5 级或手骨龄片桡骨骨骺基本闭合 (女孩骨龄 15 岁)^[9]。收集随访的系列临床和影像学资料: X 线片记录顶椎 (畸形) 位置、Cobb 角、Risser 征、骨龄; 记录患儿每日实际佩戴支具时间。

1.3 一般资料

根据纳入和排除标准, 2016 年 1 月~2018 年 6 月采用色努支具治疗的 AIS 患儿 49 例纳入研究 (男性 3 例, 女性 46 例), 开始治疗时平均年龄 12.6 ± 1.3 岁 (10~15 岁), 初始 Risser 征: 2.2 ± 1.6 (0~4)。初始主弯 Cobb 角 $32.5^{\circ}\pm 6.9^{\circ}$ ($20^{\circ}\sim 43^{\circ}$), 按严重程度分组: Cobb 角 $20^{\circ}\sim 29^{\circ}$ 患儿 17 例, Cobb 角 $30^{\circ}\sim 39^{\circ}$ 患儿 22 例, Cobb 角 $40^{\circ}\sim 45^{\circ}$ 患儿 10 例。按照顶椎位置将畸形分为: 胸弯 (T2~T11)、胸腰弯 (T12~L1)/腰弯 (L2~L4) 和双主弯 (包括胸弯和腰弯两个结构性主弯); 分别为胸弯 16 例, 胸腰弯/腰弯 20 例, 双主弯 13 例。

1.4 评价标准

佩戴支具后即刻拍摄 X 线片, 记录畸形矫正程度, 根据原始 Cobb 角和佩戴支具后 Cobb 角计算初始支具矫正率。初始支具矫正率 = (原始 Cobb 角 - 佩戴支具后 Cobb 角) / 原始 Cobb 角。依据末次随访 Cobb 角, 按照依据脊柱侧凸研究协会评定标准^[10]: (1) 若 Cobb 角减少 $\geq 6^{\circ}$ 定义为“改善”; (2) Cobb 角变化 5° 以内定义为“稳定”; (3) Cobb 角增大 $\geq 6^{\circ}$ 定义为“进展”。将改善和稳定定义为治疗成功。

1.5 数据统计

应用 SPSS 18.0 统计软件进行数据录入及处理。统计初始支具矫正率 (治疗因素) 在稳定组、改善组和进展组之间的差异及相关性; 分析畸形进展的患者相关因素: 畸形位置、严重程度、Risser 征; 并分析影响初始支具矫正率的可能影响因素。连续性变量以均数 $\pm$ 标准差 (最小值-最大值) 描

述, 分类变量以频数来描述。采用 Spearman 相关系数表示连续性变量与有序多分类变量的相关性大小。连续性变量的组间比较采用方差分析, 率的比较采用卡方检验。多因素分析中, 结局为连续性变量, 采用多因素方差分析。结局为有序多分类变量采用有序多分类 Logistic 回归。以双侧检验 $P < 0.05$ 为差异有统计学意义。

2 结果

49 例患儿佩戴支具后即刻的初始支具矫正率为 $(64.9\pm 23.6)\%$ ($24\%\sim 100\%$)。随访 2.0 ± 1.0 年 (1~5 年), 支具每天佩戴时间超过 18~20h, 末次随访年龄 14.6 ± 1.4 岁 ($12.1\sim 17.6$ 岁), Risser 征 4.2 ± 0.6 (3~5)。末次随访主弯 Cobb 角: $28.5^{\circ}\pm 9.6^{\circ}$ ($8^{\circ}\sim 55^{\circ}$)。总体的治疗成功率 91.8% (45/49), 其中 31 例 (63%) 畸形程度改善 (图 1, 2), 14 例 (29%) 畸形稳定, 4 例患儿畸形进展 (8.2%), 其中 3 例超过 45° , 保守治疗失败 (图 3); 其中改善组术前 Cobb 角 $32.7^{\circ}\pm 6.3^{\circ}$, 治疗后 Cobb 角 $25.9^{\circ}\pm 8.7^{\circ}$, 平均矫正 7° , 矫正率为 22%。

2.1 初始支具矫正率与治疗结果的相关性

改善、稳定、进展三组的初始支具矫正率分别为 $(69.5\pm 23.2)\%$ 、 $(61.5\pm 23.7)\%$ 和 $(42.5\pm 10.0)\%$, 初始支具矫正率和各组结果存在中等强度相关性, Spearman 相关系数 0.318 ($P=0.026$); 有序多分类 Logistic 回归显示支具矫正率对结果存在正向影响, 初始支具矫正率越高, 结果越优, 差异有显著统计学意义 ($P=0.045$, OR: 10.3, 95%CI: 1.00~1.06)。

2.2 畸形进展的影响因素

分析畸形进展率在畸形严重程度的三组间差异发现, 随着畸形程度的增加, 畸形进展率逐渐提高, 分别为 0%、5% 和 30%, 差异有统计学差异 ($P=0.016$); 进展率在不同侧弯类型之间差异无统计学差异 ($P=0.124$), 但 4 例进展中的 3 例发生在胸弯组, 1 例发生在双主弯组, 均在胸段侧弯发生进展, 胸腰弯/腰弯组无进展病例。进展率在初始 Risser 征的组间差异有统计学差异 ($P=0.010$), 进展的 4 例病例, 3 例初始 Risser 征为 0, 且进展均超过 45° , 1 例初始 Risser 征为 1, 畸形进展, 但控制在 45° 以内, 初始 Risser 征为 2~4 的患儿无进展病例 (表 1)。

2.3 初始支具矫正率的影响因素

多因素分析畸形程度、侧弯类型和 Risser 征对初始支具矫正率的影响,发现畸形程度越低,初始支具矫正率越高:20°~29°组初始支具矫正率最高 80.8%,30°~39°组为 61.5%,40°~45°组的最低为 45.3%,差异有统计学差异($P=0.001$)。胸弯、胸腰弯/腰弯和双主弯的初始支具矫正率分别为 59.1%、63.2%和 64.3%,差异无统计学差异 ($P=$

0.77);各初始 Risser 征的初始支具矫正率的组间差异无统计学差异($P=0.725$,表 1)。

3 讨论

本研究证实了支具治疗 AIS 的临床效果,可有效改变其自然病程,阻止在生长发育期畸形的进展,本组病例治疗的成功率为 91.8%,并且

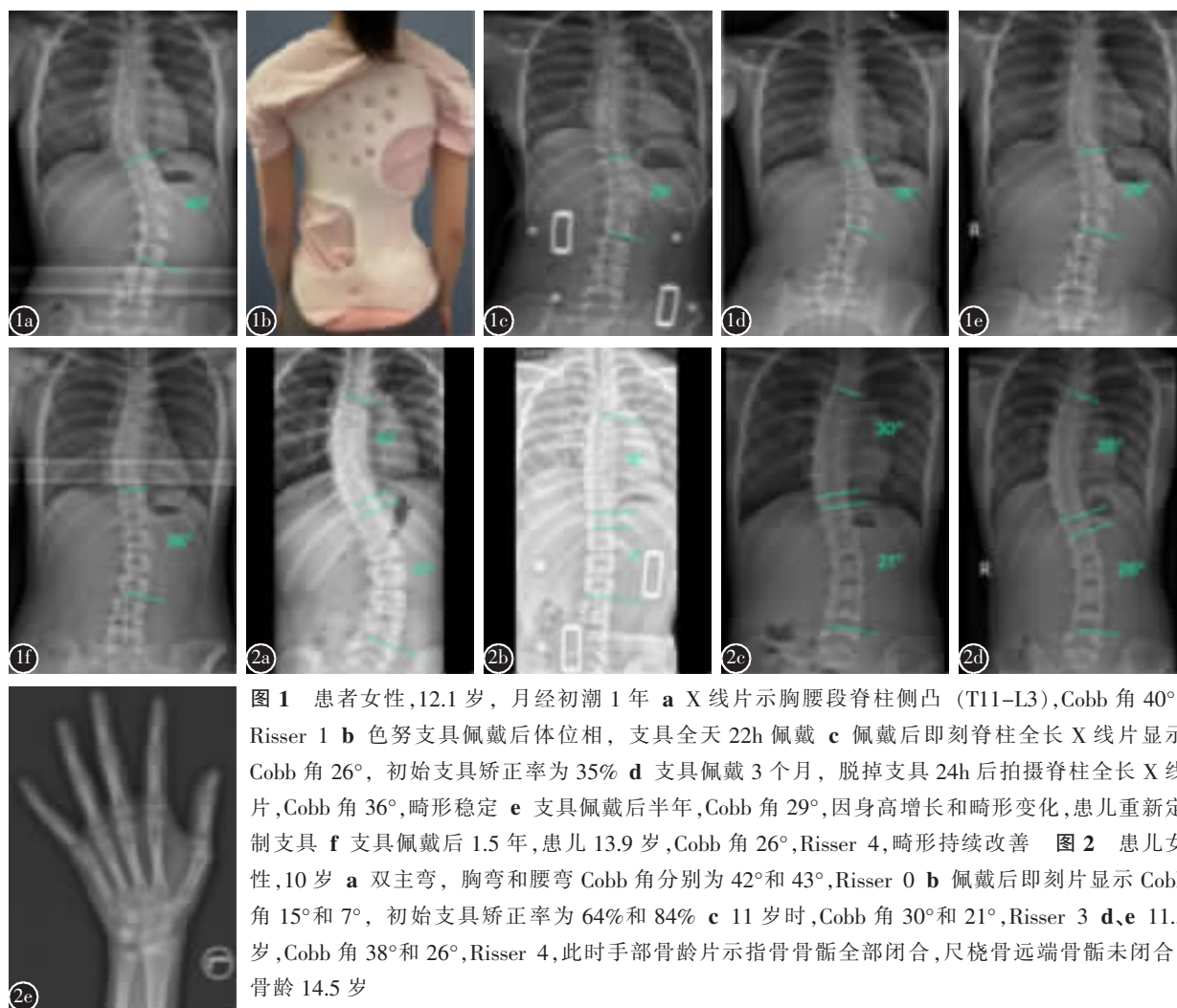


图 1 患者女性,12.1 岁,月经初潮 1 年 **a** X 线片示胸腰段脊柱侧凸 (T11-L3),Cobb 角 40°,Risser 1 **b** 色努支具佩戴后体位相,支具全天 22h 佩戴 **c** 佩戴后即刻脊柱全长 X 线片显示 Cobb 角 26°,初始支具矫正率为 35% **d** 支具佩戴 3 个月,脱掉支具 24h 后拍摄脊柱全长 X 线片,Cobb 角 36°,畸形稳定 **e** 支具佩戴后半年,Cobb 角 29°,因身高增长和畸形变化,患儿重新定制支具 **f** 支具佩戴后 1.5 年,患儿 13.9 岁,Cobb 角 26°,Risser 4,畸形持续改善 **图 2** 患儿女性,10 岁 **a** 双主弯,胸弯和腰弯 Cobb 角分别为 42°和 43°,Risser 0 **b** 佩戴后即刻片显示 Cobb 角 15°和 7°,初始支具矫正率为 64%和 84% **c** 11 岁时,Cobb 角 30°和 21°,Risser 3 **d**、**e** 11.5 岁,Cobb 角 38°和 26°,Risser 4,此时手部骨龄片示指骨骨骺全部闭合,尺桡骨远端骨骺未闭合,骨龄 14.5 岁

Figure 1 A 12.1-year-old girl, menarche for 1 year **a** X-ray showed thoracolumbar scoliosis (T11-L3), Cobb angle 40°, Risser 1 **b** The photograph of the girl in brace, and the brace was worn for 22h/d **c** X-ray immediately after bracing, showed that the Cobb angle was 26°, and in-brace correction rate was 35% **d** The brace was worn for 3 months, and the X-ray was taken 24 hours after taking off the brace. The Cobb angle was 36 degrees, and the deformity was stable **e** Half a year after wearing the brace, the Cobb angle was 29°, and the brace was remade due to height growth and deformity changes **f** 1.5 years after wearing the brace, the child was 13.9 years old, the Cobb angle was 26°, Risser 4, and the deformity continued to improve **Figure 2** A 10-year-old girl **a** AIS with double major curve, the Cobb angles of thoracic curve and lumbar curve were 42° and 43° respectively, Risser 0 **b** X-ray taken immediately after bracing, showed that Cobb angle was 15° and 7°, and in-brace correction rates were 64% and 84% **c** 11 years old, Cobb angle 30° and 21°, Risser 3 **d**, **e** 11.5 years old, Cobb angle 38° and 26°, Risser 4, The bone age film of the hand showed that all the epiphysis of the finger were closed, and the epiphysis of the distal radius and ulna were not closed. The bone age was 14.5 years old

61.2%的患儿畸形程度得到了不同程度的矫正。统计分析影响结果的相关因素发现:低初始支具矫正率、畸形程度严重、骨骼成熟度低的胸段侧凸患儿,支具治疗后畸形更容易进展。

AIS 的自然病程已有较明确的结论:在发育期,畸形程度会随着身高的增长而增长;骨骼成熟后,30°以内的畸形可以长期稳定,如果畸形程度超过 50°,则会逐年进展,最快达到 1°/年^[2,11]。建议早期发现和早期治疗,以控制畸形的进展。支具治疗被证实是能够改变脊柱侧凸自然病程的有效治疗方法。北美的 Weinstein 发起的一项多中心随机对照研究^[12](Bracing in adolescent idiopathic scoliosis trial, BrAIST),对比了支具治疗和观察随访,研究入组标准为 Cobb 角 25°~40°(SRS 标准),发现支具治疗组的成功率(最终 Cobb 角<50°)为 72%,观察组的成功率为 48%,差异有统计学意义。研究同时还发现,支具治疗的成功率和支具每天佩戴时间显著相关($P<0.001$),如果每天佩戴小于 6h,成功率为 41%,和观察组类似;如果每天佩戴超过 12.9h 则成功率上升至 90%^[13]。本研究组的患儿依从性较好,每天佩戴支具的时间平均在 18~20h 以上,是本组较高成功率原因之一。

除了支具佩戴依从性之外,文献报道不同支具类型也会产生不同的疗效。常用支具如 Boston 支具, Milwaukee 支具和 Charleston 支具等^[14]。本研究采用的色努支具由德国的雅克·色努在 1978 开发,通过对顶椎附近的加压和抗旋转,提供了对畸形的三维矫正^[15]。相对于常用的 Boston 支具,色

努支具有更好的矫形效果。Minsk 对比了色努支具和 Boston 支具的疗效,结果 Boston 支具组 34%需要手术,而色努支具组没有需要手术的病例^[16]。意大利的 Giorgi 发现对于单弯患儿,色努支具治疗的初始支具矫正率达到 72%,全天 23h 佩戴,在平均 5 年的随访后,100%的患儿畸形得到控制,且最终脱掉支具后的畸形平均矫正程度达到了 59.3%^[7]。本研究应用的色努支具在初始支具矫正率及最终结果方面与文献报道类似,充分证实了该治疗策略的有效性。其他影响治疗结果的因素包括:初始支具矫正率、畸形程度、Risser 征、畸形类型等。

3.1 初始支具矫正率对疗效的影响

较高的初始支具矫正率是治疗成功的关键。Katz^[17]发现要成功治疗双主弯,至少需要 25%的初始支具矫正率。Castro 等^[18]发现若初始支具矫正率小于 20%结果较差。一般认为初始支具矫正率最好超过 40%~50%^[19]。一些报告成功率超过 90%的作者获得了更大的矫正率。Weiss 等^[20]的研究平均矫正率为 66%,De Mauroy 等^[21]的研究平均矫正率为 70%(胸弯 64%,腰弯 76%)。本研究中患儿有较高的初始支具矫正率(平均 64.9%),其中改善组的矫正率为 69.5%,稳定组为 61.5%,进展组为 42.5%,差异有显著统计学意义。各畸形类型的矫正率虽然无统计学差异,但胸腰弯/腰弯的平均矫正率(69%)较胸弯的矫正率(61%)略高。

3.2 畸形程度对疗效的影响

畸形程度越重,畸形进展的可能性越大,可能

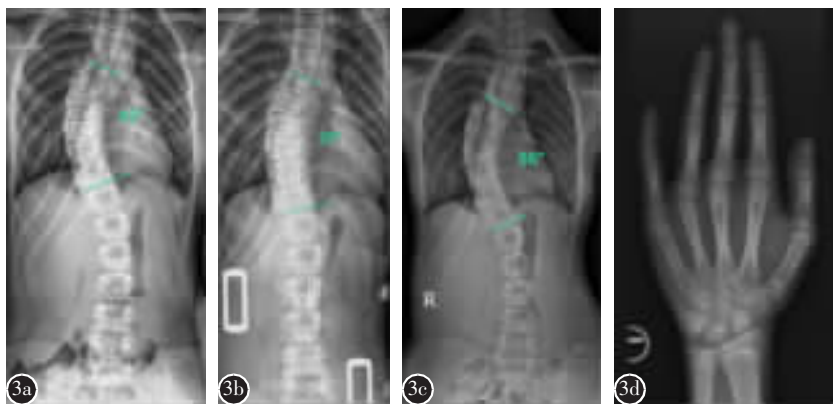


图 3 女性,12.1 岁 a 胸弯 Cobb 角 43°,Risser 0 b 佩戴后即刻 X 线片显示 Cobb 角 29°,初始支具矫正率为 33% c、d 13 岁时,畸形进展,Cobb 角 56°,保守治疗失败,改行手术治疗。手部骨龄片示指骨骨骺覆盖于骺端但未闭合,骨龄为 12 岁,

Figure 3 a A 2.1-year-old female, T curve with Cobb angle of 43°, Risser 0 b X-ray taken immediately after bracing showed that the Cobb angle was 29°, and in -brace

correction was 33% c, d 13 years old, deformity progression, Cobb angle 56°, conservative treatment failed, and surgical treatment was planned. The bone age film of the hand showed that the epiphysis of the phalanges was capping but not closed. The bone age was 12 years old

导致治疗失败的几率越大。Katz 等^[17]发现如果初始胸弯大于 35° 的双主弯进展的可能性更大。Sun 等^[22]观察到初始 Cobb 角大于 30° 是畸形进展的独立危险因素。Karol 发现骨骼成熟度低(Risser 0, Y 型软骨未闭合)且畸形较严重(30°~39°)的患儿进展风险更高^[23]。本研究支持该观点,4 例进展病例中 3 例初始 Cobb 角超过 40° 且 Risser 征为 0。随着畸形程度的增加,统计发现初始支具矫正率会逐渐减低,也是导致治疗失败的内在原因之一。提示 AIS 在畸形程度较轻时及早治疗,可提高治疗成功率。

3.3 Risser 征对疗效的影响

骨骼成熟度是影响 AIS 畸形进展的另一重要

表 1 畸形程度、畸形类型、骨骼成熟度对治疗结果及初始支具矫正率的影响

Table 1 The influence of deformity magnitude, curve type, bone maturity on the results and in-brace correction

	改善(n) Improvement	稳定(n) Stable	进展(n) Worsen	初始支具矫正率(%) In-brace correction
畸形程度 Deformity magnitude				
20°~29°	11	6	0	80.8±20.3
30°~39°	15	6	1	61.5±21.4
40°~45°	5	2	3	45.3±14.9
P 值 P value			0.016	0.001
侧弯类型 Curve type				
胸弯 T curve	10	3	3	60.9±21.6
胸腰/腰弯 TL/L curve	13	7	0	68.6±23.6
双主弯 Double major	8	4	1	64.0±26.6
P 值 P value			0.124	0.770
初始 Risser 征 Initial Risser score				
0	7	2	3	73.5±25.0
1	4	1	1	60.0±23.1
2	4	3	0	67.0±27.5
3	6	1	0	65.0±20.2
4	10	7	0	59.0±23.1
P 值 P value			0.010	0.725

因素。评价骨骼成熟度的临床指标包括实际年龄、身高、月经初潮时间等,影像学指标包括髂骨 Risser 征、尺骨鹰嘴骨骺、手骨龄 X 线片等。其中 Risser 征是最常用和最简易的评估方法。很多作者观察到较低的 Risser 征分级与更高的失败风险相关联^[22,23]。本研究 4 例进展的病例,3 例发生在 Risser 0,1 例发生在 Risser 1,此时为身高增长最快阶段,畸形进展的速度也最快,因此即使采用了支具治疗且全天佩戴,畸形进展的风险仍较高。正常女孩在骨龄 11 岁左右进入青春期,经过 2 年的快速生长期,在 13 岁左右月经初潮,此时髂骨翼最外侧出现二次骨化中心(Risser 1),在骨龄 14.5 岁左右髂骨骨骺可全部出现(Risser 4),从 Risser4 到骨骺全部融合(Risser 5)的时间较长,最长可达 4 年时间,因此我们对 Risser 4 的患儿也积极地进行了治疗,改善率为 59%。

3.4 侧凸类型对疗效的影响

基于三点矫正原理,支具对中下段的胸腰弯和腰弯的具有更好的控制力,Toru 的病例系列中,胸腰弯和腰弯的矫正率为 73%,胸弯的矫正率为 34%,双主弯的矫正率为 48%^[24]。Emans 也发现低位的胸弯和胸腰弯(顶椎水平低于 T8 且高于 L2)初始支具矫正率更高^[25]。而对上胸段畸形的支具控制力相对不足,且胸椎柔韧性较低,因此胸弯和双主弯更容易进展^[21]。本研究结果也同样表明胸腰弯/腰弯的支具内矫正率和改善率最高,进展的 4 例病例全部发生在胸段侧凸。

本研究的局限性:本组队列研究的平均随访时间仍较短,末次随访 Risser 征平均 4.2,部分患儿骨骼仍未完全成熟,畸形仍有变化可能;另外,脱除支具后的畸形变化情况仍需长期观察。

色努支具是治疗 AIS 的有效方法,本组病例通过全天佩戴(18~20h 以上),可有效控制畸形进展,超过一半的患者畸形可部分矫正。佩戴支具后的初始矫正率和结果密切相关,初始支具矫正率越高,治疗效果越优。畸形程度严重(>40°)和骨骼成熟度低(Risser 0)的胸段侧凸患儿,畸形进展的可能性更大。

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