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# 平衡性训练对膝关节内侧副韧带损伤患者膝关节功能恢复的效果研究\*

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**摘要 目的:** 研究平衡性训练对膝关节内侧副韧带(MCL)损伤患者膝关节功能恢复的效果。**方法:** 选取 2014 年 8 月至 2016 年 8 月北京体育大学运动员膝关节 MCL 损伤患者 112 例为研究对象, 根据随机数字表法将其分为对照组(n=56)与观察组(n=56)。对照组予以常规康复训练干预, 观察组则在对照组的基础上加用平衡性训练干预, 两组患者干预时间均为 4 周, 分别比较两组干预前和干预 4 周后膝关节功能变化情况、疼痛程度、膝关节平衡能力以及生活质量的变化。**结果:** 干预后两组患者 Lysholm 评分均较干预前升高, 且观察组明显高于对照组, 差异有统计学意义( $P<0.05$ )。干预后两组患者视觉模拟(VAS)评分均明显低于干预前, 且观察组明显低于对照组, 差异均有统计学意义(均  $P<0.05$ )。干预后, 两组患者总体稳定指数(OSI)、前后方向的稳定指数(APSI)、左右方向的稳定指数(MLSI)水平均低于干预前, 且观察组患者 OSI、APSI、MLSI 水平均低于对照组, 差异均有统计学意义(均  $P<0.05$ )。观察组患者满意度较对照组明显升高, 差异有统计学意义( $P<0.05$ )。**结论:** 为膝关节 MCL 损伤患者实施平衡性训练能较好地改善其膝关节功能, 并缓解疼痛, 同时可帮助其提高膝关节的平衡能力, 增加了满意度, 适于推广。

**关键词:** 膝关节; 内侧副韧带; 损伤; 平衡性训练; 膝关节功能; 效果

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## Effect of Balance Training on the Recovery of Knee Joint Function in Patients with Medial Collateral Ligament Injury of Knee Joint\*

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**ABSTRACT Objective:** To study the effect of balance training on the recovery of knee joint function in patients with medial collateral ligament (MCL) injury of knee joint. **Methods:** 112 athletes with knee joint MCL injury in Beijing Sport University from August 2014 to August 2016 were selected as the research object, and they were divided into control group (n=56) and observation group (n=56) according to the random number table method. The control group was given routine rehabilitation training, while the observation group was given balanced training intervention on the basis of the control group, the intervention time of the two groups was 4 weeks. The changes of knee joint function, pain degree, knee joint balance ability and quality of life were compared between the two groups before and after 4 weeks of intervention. **Results:** After intervention, the Lysholm scores of patients in two groups were higher than before intervention, and the observation group was significantly higher than that of the control group, the difference was statistically significant ( $P<0.05$ ). After intervention, the visual analogue scores (VAS) of patients in two groups were significantly lower than those before intervention, and the observation group was significantly lower than that of the control group, the differences were statistically significant ( $P<0.05$ ). After intervention, the levels of overall stability index (OSI), anterior-posterior stability index (APSI), medial-lateral stability index (MLSI) of patients in two groups were lower than those before intervention, and the levels OSI, APSI and MLSI of patients in the observation group were lower than the control group, the differences were statistically significant ( $P<0.05$ ). The satisfaction of the observation group was significantly higher than that of the control group, the difference was statistically significant ( $P<0.05$ ). **Conclusion:** Balanced training for patients with knee joint MCL injury can improve their knee joint function, relieve pain, and it can help them improve the balance capacity of the knee joint, increase satisfaction, which is suitable for promotion.

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## 前言

膝关节韧带损伤属于骨科临床上较为常见的一类损伤性疾病<sup>[1]</sup>。而在体育大学的教练员、运动员中膝关节损伤的发生率明显高于正常人群,其中篮球运动、足球运动、排球运动等均是对抗性较强的运动,在激烈的比赛中互相碰撞以及犯规动作等均有可能导致膝关节损伤。而膝关节内侧副韧带(Medial collateral ligament, MCL)是膝关节内侧的主要稳定结构,其作用是维持膝关节稳定,防止膝外翻与膝外旋的发生,亦是最容易受到损伤的韧带<sup>[2]</sup>。相关研究报道显示<sup>[3]</sup>,膝关节 MCL 损伤在所有膝关节损伤中占比约为 40%,且大部分患者通常会合并膝关节其他韧带的损伤,将对患者的肌肉工作能力和全身运动质量产生影响,进而导致运动员无法参加正常训练与比赛,严重时甚至会使运动员致残。另有研究报道证实<sup>[4]</sup>,在经保守治疗后,膝关节 MCL 损伤患者膝关节功能不能完全恢复,其内侧不稳与关节疼痛等症状也不能完全缓解,这在一定程度上增加了再次损伤的风险。因此,对膝关节 MCL 损伤患者进行有效的康复训练显得尤为重要。本文通过研究平衡性训练对膝关节 MCL 损伤患者膝关节功能恢复的效果,结果整理如下。

## 1 资料与方法

### 1.1 一般资料

选取 2014 年 8 月至 2016 年 8 月北京体育大学运动员膝关节 MCL 损伤患者 112 例进行研究。膝关节 MCL 损伤诊断标准如下<sup>[5]</sup>:(1)既往有受过外伤;(2)膝关节肿胀疼痛伴有皮下淤青,伸展时呈半屈曲位,且存在功能障碍;(3)膝关节侧副韧带经分离试验检查呈阳性;(4)X 线片显示伤侧关节存在间隙增宽、轻度错位、撕脱性骨折中的一种症状。纳入标准:(1)年龄 $\geq 18$ 周岁;(2)均符合膝关节 MCL 损伤诊断标准,且病情严重程度均为轻、中度患者;(3)患者对本研究知情同意。排除标准:(1)伴有股骨骨折或胫、腓骨骨折者;(2)治疗或训练依从性差者;(3)最终资料缺失者;(4)发生严重不良事件导致治疗无法顺利完成者。根据随机数字表法将患者分为观察组( $n=56$ )与对照组( $n=56$ )。其中观察组男性 32 例,女性 24 例,年龄 19~28 岁,平均年龄( $25.3 \pm 2.1$ )岁。对照组男性 31 例,女性 25 例,年龄 19~27 岁,平均年龄( $25.6 \pm 2.5$ )岁。两组一般资料比较无统计学差异( $P>0.05$ )。

### 1.2 研究方法

对照组予以常规康复训练,即红外线联合电针治疗,同时予以股四头肌力量训练。观察组则在对照组的基础上加用平衡性训练干预,即在教练员的监督指导下完成 3 组时长为 15 min 的平衡板训练,具体方式如下:双手叉腰,单脚屈膝站立在平衡板上,应用患侧膝关节控制全身平衡,过程中保持膝部超出脚趾的姿势,根据患者的病情康复情况逐渐增加训练难度,由睁眼完成训练逐渐过度至闭眼完成训练。对两组患者均进行为期 4 周的训练干预。

### 1.3 观察指标

分别比较两组干预前和干预 4 周后膝关节功能的变化情况、疼痛程度、膝关节平衡能力以及生活质量情况。其中膝关节功能的变化情况主要是通过 Lysholm 膝关节功能评分进行判定,该评分系统主要包括(1)头痛,(2)跛行,(3)肿胀度,(4)蹲姿,(5)不安定度,(6)闭锁感,(7)使用支撑物,(8)楼梯攀爬,总分 0~100 分,得分越高表示患者的膝关节功能越好<sup>[6,7]</sup>。采用视觉模拟评分(Visual analogue scale, VAS)评估患者的疼痛程度,此评分的总分为 0~10 分,得分越高表示患者的疼痛程度也越剧烈<sup>[8]</sup>。膝关节平衡能力的评估主要是通过动态 BIODEX 平衡系统评价,主要包括(1)总体稳定指数(Overall stability index, OSI),(2)前后方向的稳定指数(Anterior-posterior stability index, APSI),(3)左右方向的稳定指数(Medial-lateral stability index, MLSI)<sup>[9,10]</sup>。其中 OSI 指平衡板在各个方向移动的位移和水平面之间偏离的度数;APSI 指平衡板在前后方倾斜面方向的位移和水平面之间偏离的度数;MLSI 指平衡板在左右方倾斜面方向的位移和水平面之间偏离的度数。采用满意度测评量表对患者的满意度进行调查评估<sup>[11,12]</sup>,主要包括(1)教练员热情与否,(2)教练员尽力服务与否,(3)教练员技能操作熟练与否等,共 10 个问题,每个问题均有是、一般以及否三个选项,其中选择是记 10 分,选一般记 5 分,选择否记 0 分。评价标准:(1)非常满意:总得分为 90~100 分;(2)一般满意:总得分为 60~90 分;(3)不满意:总得分 $<60$  分。满意度 = 非常满意度 + 一般满意度。

### 1.4 统计学方法

本研究数据均采用 SPSS21.0 软件进行统计分析,满意度等计数资料以率(%)表示,组间数据采用  $\chi^2$  检验, Lysholm 评分、VAS 评分及 OSI、APSI、MLSI 水平等计量资料均以均数 $\pm$ 标准差( $\bar{x} \pm s$ )表示,组间数据采用 t 检验,检验标准设置为 $\alpha=0.05$ 。

## 2 结果

### 2.1 干预前后两组患者 Lysholm 评分对比

干预前, 研究组与对照组患者 Lysholm 评分分别为( $42.33 \pm 12.04$ )分、( $42.38 \pm 12.07$ )分,两组比较差异无统计学意义( $t=0.000, P=1.000$ );干预后观察组与对照组患者 Lysholm 评分分别为( $70.44 \pm 10.51$ )分、( $64.87 \pm 11.32$ )分,均明显高于干预前( $t=13.162, 10.171, P=0.000, 0.000$ ),且观察组明显高于对照组( $t=2.698, P=0.008$ )。

### 2.2 干预前后两组患者 VAS 评分对比

干预前, 两组患者 VAS 评分分别为( $5.02 \pm 1.59$ )分、( $5.04 \pm 1.61$ )分,两组比较差异无统计学意义( $t=0.000, P=1.000$ );干预后观察组与对照组患者 VAS 评分分别为( $1.97 \pm 0.95$ )分、( $2.61 \pm 1.02$ )分,均较干预前明显降低( $t=12.323, 9.547, P=0.000, 0.000$ ),且观察组明显低于对照组( $t=3.436, P=0.001$ )。

### 2.3 干预前后两组患者 OSI、APSI、MLSI 水平对比

干预前, 两组患者 OSI、APSI、MLSI 水平比较差异无统计学意义 ( $P>0.05$ ); 干预后, 两组患者 OSI、APSI、MLSI 水平均低

于干预前, 且观察组患者 OSI、APSI、MLSI 水平均明显低于对照组, 差异有统计学意义 (均  $P<0.05$ )。见表 1。

表 1 干预前后两组患者 OSI、APSI、MLSI 水平对比 ( $\bar{x}\pm s$ )

Table 1 Comparison of levels of OSI, APSI and MLSI between the two groups before and after intervention ( $\bar{x}\pm s$ )

Groups	OSI		APSI		MLSI	
	Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention
Observation group (n=56)	2.18± 0.95	1.54± 0.29*	1.58± 0.66	1.05± 0.30*	1.29± 0.61	0.84± 0.35*
Control group (n=56)	2.17± 0.97	1.91± 0.44*	1.59± 0.68	1.49± 0.34*	1.30± 0.62	1.14± 0.17*
t	0.055	5.254	0.079	7.262	0.086	5.770
P	0.956	0.000	0.937	0.000	0.932	0.000

Note: compared with before intervention, \* $P<0.05$ .

### 2.4 两组患者满意度对比

观察组患者满意度明显较对照组升高, 差异有统计学意义

( $P<0.05$ )。见表 2。

表 2 两组患者满意度对比[n(%)]

Table 2 Comparison of satisfaction between the two groups [n (%)]

Groups	n	Very satisfied	General satisfaction	Dissatisfied	Satisfaction
Observation group	56	28(50.00)	25(44.64)	3(5.36)	53(94.64)
Control group	56	23(41.07)	22(39.29)	11(19.64)	45(80.36)
$\chi^2$	-				5.224
P	-				0.022

## 3 讨论

膝关节内侧的副韧带起始于股骨内踝结节, 止于胫骨内踝的内侧面, 通常与交叉韧带、外侧副韧带及髌韧带共同维持机体膝关节的稳定性<sup>[13-15]</sup>。现代医学证明, 膝关节处于半屈曲位时, 侧副韧带通常较为松弛, 从而易使关节不稳, 此时若突然进行过猛的膝外翻动作亦或是膝外侧遭受暴力打击, 则极易导致膝关节的过度外翻和外旋, 进一步致使韧带受损而引起膝关节 MCL 损伤<sup>[16-18]</sup>。膝关节 MCL 损伤患者的主要症状表现包括关节局部疼痛肿胀、行走困难和屈伸功能受限等, 可对患者日常生活造成较大的影响<sup>[19-21]</sup>。而对于体育大学的教练员以及运动员而言, 膝关节损伤不仅会对其生活质量造成影响, 甚至会影响其今后的人生走向。因此, 对于膝关节损伤应高度重视, 并在日常的教学训练以及比赛中尽量减少或避免。有报道指出, 平衡性训练对于韧带损伤患者的关节功能具有一定的改善作用<sup>[22-24]</sup>。鉴于此, 本文通过研究平衡性训练对膝关节 MCL 损伤患者膝关节功能恢复的效果, 以期对膝关节 MCL 损伤患者提供一种最佳的康复训练方案, 从而更好地改善其预后。

本研究结果显示, 干预后观察组与对照组患者 Lysholm 评分均明显高于干预前, 且观察组明显高于对照组 ( $P<0.05$ )。这提示了观察组与对照组所应用的两种干预方式均能有效地提升患者的 Lysholm 评分, 但观察组的改善效果却明显优于对照组。原因可能与观察组应用的平衡性训练从控制身体平衡和帮助关节承重等方面更好地改善了患者的膝关节功能有关。此

外, 干预后观察组与对照组患者的 VAS 评分均明显低于干预前, 且观察组明显低于对照组 ( $P<0.05$ )。这表明了本研究所用的两种干预方式均可有效缓解患者的膝关节局部疼痛情况, 但应用平衡性训练干预的观察组缓解效果更佳。原因主要在于平衡性训练能够帮助患者控制其疼痛阈值, 其可通过科学地刺激关节活动达到缓解疼痛的目的。另外, 干预后两组患者 OSI、APSI、MLSI 水平均低于干预前, 且观察组患者 OSI、APSI、MLSI 水平均低于对照组 ( $P<0.05$ )。这提示了将平衡性训练应用于膝关节 MCL 损伤患者中, 可显著提高其膝关节的平衡能力。同时也提示对于膝关节 MCL 损伤患者不仅要训练其股四头肌的力量, 同时还应训练膝关节的平衡能力, 两者同时进行, 从而为患者提供最全面的康复训练, 促进其早日康复<sup>[25-27]</sup>。本文研究结果还显示观察组患者的满意度明显高于对照组 ( $P<0.05$ )。这提示了平衡性训练干预可显著提高患者的满意度。主要原因可能是因为平衡性训练能有效改善了患者的膝关节功能, 并帮助其缓解了疼痛症状, 加之其平衡能力的逐渐康复和膝关节平衡性训练具有简单易行等特点, 更有利于患者积极接受, 最终增加其对教练员的信任与依赖, 提升了满意度<sup>[28-30]</sup>。然而, 本研究尚且存在以下几点缺陷: (1) 样本量不足, 从而可能导致研究结果的准确度发生一定程度的偏差; (2) 未对膝关节 MCL 损伤的再伤患者进行分组观察, 从而可能对预后的研究结果产生一定的影响。因此, 在今后的研究中应增大样本量, 同时可根据膝关节 MCL 损伤患者是否为再伤人群进行进一步的分组和对比, 从而为具有针对性的平衡性康复训练方案的制定提供参考依据。

综上所述,将平衡训练应用于运动员膝关节 MCL 损伤患者的治疗可有效改善其膝关节功能,帮助其减轻疼痛,同时还可提高患者膝关节的平衡能力以及对训练的满意度,可以推广使用。

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的危险因子<sup>[9]</sup>。在本研究中,采用联合益气宁心汤治疗的患者 sST2、APN 水平显著低于采用单一贝那普利治疗的患者,说明了益气宁心汤能够纠正心肌细胞的代谢,改善心功能,抑制 sST2、APN 的分泌。GDF-15 是一种应激反应蛋白,可检测患者的死亡风险以及预后<sup>[21]</sup>。国外研究显示<sup>[20]</sup>心力衰竭患者的血清 GDF-15 水平显著高于正常人,GDF-15 水平能够反映心力衰竭患者的病情以及心室重构程度<sup>[22]</sup>。本研究显示采用联合益气宁心汤治疗的患者 GDF-15 水平显著低于采用单一贝那普利治疗的患,说明益气宁心汤能够抑制心室重构,保护心肌细胞<sup>[23]</sup>。

综上所述,益气宁心汤联合贝那普利治疗慢性心衰患者的临床疗效及对血清生长分化因子-15(GDF-15)、可溶性 ST2 蛋白(sST2)、脂联素(APN)的影响。

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