

改良牵伸康复方案治疗下肢骨折后膝关节僵硬临床研究

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【摘要】 目的:探讨改良牵伸康复方案对下肢骨折后膝关节僵硬患者关节活动度及功能状态的影响。方法:回顾性纳入我院 2018 年 1 月—2020 年 3 月收治下肢骨折后膝关节僵硬患者共 146 例,根据康复方案差异分组,其中采用常规康复干预治疗患者共 86 例(对照组),在此基础上加用改良牵伸康复方案治疗患者共 60 例(观察组);比较 2 组治疗前后膝关节主动活动度、HSS 评分及近期疗效。结果:2 组治疗后较治疗前膝关节主动活动度和 HSS 评分均显著增加($P < 0.05$),且观察组显著高于对照组($P < 0.05$);观察组近期治疗显效率显著高于对照组($P < 0.05$)。结论:改良牵伸康复方案用于下肢骨折后膝关节僵硬患者可有效缓解临床症状,提高关节活动度,并有助于改善关节功能状态。

【关键词】 康复;下肢骨折;膝关节僵硬;关节活动度;功能

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【Abstract】 Objective: To investigate the influence of modified stretching rehabilitation technology on joint range of motion and functional state in patients with knee joint stiffness after lower limb fracture. **Methods:** Totally, 146 patients with knee joint stiffness after lower limb fracture were chosen in the period from January 2018 to March 2020 and divided into 2 groups according into treatment scheme differences including control group (86 patients) with routine rehabilitation intervention and experiment group (60 patients) with modified stretching rehabilitation technology on the basis of control group. The short-term clinical effect, active range of motion and HSS score of knee joint before and after treatment of 2 groups were compared. **Results:** The knee active range of motion and HSS score in two groups after treatment were significantly greater than before treatment ($P < 0.05$). The knee active range of motion and HSS score in the experiment group after treatment were significantly increased as compared with those in the control group ($P < 0.05$). The short-term excellent effective rate in the experiment group was significantly higher than in the control group ($P < 0.05$). **Conclusion:** Modified stretching rehabilitation technology in the treatment of patients with knee joint stiffness after lower limb fracture can effectively relieve clinical symptoms, increase the joint interaction and be helpful to improve joint function.

【Key words】 traction; rehabilitation; lower limb fracture; knee stiffness; joint range of motion; function

膝关节僵硬是膝关节严重创伤后严重并发症之一,往往表现为屈曲或伸直性僵硬症状,如未及时处理可导致日常工作生活质量严重下降,不利于临床预后改善^[1]。目前针对膝关节僵硬治疗主要包括保守和手术两类,其中保守治疗可有效缓解患者疼痛不适症状,降低感染发生风险,临床应用较为广泛^[2];但膝关节周围软组织存在胶原弹力回缩问题,常规保护治疗手段往往短期改善效果欠佳,且治疗后复发风险较高^[3]。改良牵伸康复方案基于渐进式牵伸理论,通过应力松弛和蠕变效应,刺激应力逐步增加并形成持久结缔组

织塑形变性作用,最终实现持久康复效果^[4]。本研究通过探讨改良牵伸康复方案对下肢骨折后膝关节僵硬患者关节活动度及功能状态的影响,旨在为临床治疗方案优化提供更多参考。

1 资料与方法

1.1 一般资料 回顾性纳入我院 2018 年 1 月~2021 年 3 月收治下肢骨折后膝关节僵硬患者共 146 例,纳入标准:骨折导致膝关节僵硬;X 线提示骨折愈合且对位对线良好;外固定已拆除;接受康复方案干预距骨折发生时间 ≤ 6 个月。排除标准:粉碎性或病理性骨折;内固定术后复位欠佳;急性感染;骨性强直或屈伸活动存在骨性阻挡;周围严重软组织损伤;骨化性肌炎。根据康复方案差异分组,其中采用常规康复干预治疗患

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者共 86 例(对照组),在此基础上加用改良牵伸康复方案治疗患者共 60 例(观察组);对照组中男性 56 例,女性 30 例;平均年龄为(39.79±5.23)岁;平均病程为(2.71±0.55)个月;根据骨折类型划分,胫腓骨近端骨折 48 例,股骨干骨折 25 例,髌骨 13 例。观察组中男性 41 例,女性 19 例;平均年龄为(39.24±5.06)岁;平均病程为(2.79±0.60)个月;根据骨折类型划分,胫腓骨近端骨折 38 例,股骨干骨折 16 例,髌骨 6 例。2 组一般资料比较差异无统计学意义。

1.2 方法 对照组采用常规康复干预,具体措施包括:①根据病变时间、骨折及韧带愈合情况选择物理因子治疗方案;②采用 Maitland 手法完成关节松动治疗;③运动疗法包含肌力训练和下肢负重训练;④本体感觉训练包含平衡垫、步行灵活性及蹬球训练。观察组则在对照组基础上加用改良牵伸康复方案:采用膝关节主动活动支具,放松身体,坐位或卧位下完成股骨中段/小腿中段固定;在合适角度下调节关节牵伸角度,以可感牵伸但无疼痛为宜;持续牵伸 5mm 后再次调节牵伸角度,每次牵伸一个关节活动方向,牵伸总时间 30min。对于屈伸同时受限者则伸膝和屈膝训练交替;以上训练均 2 次/d,训练完毕后间歇冰敷 5min。2 组疗程均为 8 周。

1.3 评定标准 ①膝关节主动活动度测量采用量角器,治疗前和治疗后 8 周进行评估;②膝关节功能状态评价采用美国特种外科医院膝关节评分(hospital of special surgery knee score, HSS)量表,分值越高提示功能状态越佳,治疗前和治疗后 8 周进行评估^[5]。③治疗 8 周后进行疗效评估,评估标准参考相关文献^[6],包括治愈、显效、有效及无效 4 级,其中显效指活动无疼痛,关节主动活动度>120°,无效指疼痛未见明显缓解,行走受限,关节主动活动度<60°。

1.4 统计学方法 选择 SPSS 18.0 软件分析数据;计量资料比较采用 t 检验,以 $\bar{x} \pm s$ 表示;计数资料比较采用 χ^2 检验,以 % 表示;以 $P < 0.05$ 为差异有统计学意义。

2 结果

2.1 2 组治疗前后膝关节主动活动度比较 2 组治疗前膝关节主动活动度比较差异无统计学意义;2 组治疗后膝关节主动活动度显著增加($P < 0.05$),且观察组显著多于对照组($P < 0.05$)。见表 1。

表 1 2 组治疗前后膝关节主动活动度比较 $^{\circ}, \bar{x} \pm s$

组别	n	治疗前	治疗后 2 个月	t	P
对照组	86	62.61±12.56	104.90±19.57	16.865	0.000
观察组	60	60.85±14.12	117.67±22.09	17.568	0.000
t		0.775	3.599		
P		0.439	0.000		

2.2 2 组治疗前后 HSS 评分比较 2 组治疗前 HSS 各项评分比较差异无统计学意义;2 组治疗后 HSS 各项评分较治疗前显著增加($P < 0.05$),且观察组显著高于对照组($P < 0.05$)。见表 2。

2.3 2 组临床疗效比较 观察组近期治疗显效率显著高于对照组($P < 0.05$)。见表 3。

表 3 2 组临床疗效比较 例

组别	n	治愈	显效	有效	无效	显效率 %
对照组	86	20	34	26	6	62.79
观察组	60	22	26	12	0	80.00
χ^2						4.971
P						0.026

3 讨论

制动干预被广泛用于膝关节周围骨折患者康复治疗,但在治疗过程中易出现周围韧带挛缩及肌肉废用性萎缩,从而导致膝关节僵硬问题出现^[7]。膝关节僵硬常规治疗手段包括物理因子治疗、关节松动、运动疗法及本体感觉训练等^[8]。关节松动术可促进膝关节囊弹性恢复,提高关节液流动性;运动疗法能够通过激活软骨细胞胶原和氨基已糖表达,提高软组织延展性;而本体感觉训练则能够提高增强患肢位置和运动感知能力;但以上训练工作量和疗效间个体差异均较大,难以满足临床治疗需要^[9-10]。

表 2 2 组治疗前后 HSS 评分比较

分, $\bar{x} \pm s$

组别	n	疼痛				功能				活动度			
		治疗前	治疗后 2 个月	t	P	治疗前	治疗后 2 个月	t	P	治疗前	治疗后 2 个月	t	P
对照组	86	9.70±1.25	21.92±4.48	24.365	0.000	7.45±1.21	10.17±1.83	11.498	0.000	7.86±1.61	9.62±2.19	6.005	0.000
观察组	60	9.48±1.12	25.26±6.74	17.890	0.000	7.69±1.37	14.42±2.89	16.299	0.000	7.72±1.77	13.77±3.74	11.326	0.000
t		1.113	3.354			1.092	10.064			0.488	7.717		
P		0.267	0.001			0.276	0.000			0.626	0.000		
组别	n	肌力				屈曲畸形				稳定性			
		治疗前	治疗后 2 个月	t	P	治疗前	治疗后 2 个月	t	P	治疗前	治疗后 2 个月	t	P
对照组	86	6.35±0.70	8.65±1.18	15.546	0.000	5.79±1.12	7.82±1.58	9.620	0.000	6.19±0.80	7.29±1.37	6.430	0.000
观察组	60	6.41±0.76	10.10±1.45	17.459	0.000	5.83±1.19	9.65±2.11	12.215	0.000	6.25±0.87	8.66±1.95	8.743	0.000
t		0.485	6.405			0.205	5.694			0.424	4.692		
P		0.629	0.000			0.838	0.000			0.672	0.000		

近年来多种类型矫形器被应用于关节僵硬康复治疗,其中以静态渐进式牵伸矫形器最受认可,在改善多类关节僵硬方面效果确切^[11]。既往研究证实^[12-13],骨骼肌应力松弛及蠕变效应在关节僵硬康复中发挥着关键作用。本次研究所采用改良牵伸康复方案依靠蠕变和应力松弛效用,在非暴力和低负荷静态渐进性牵伸力作用下,可实现关节活动度增加,并有助于预防或减少膝关节再次损伤。有学者采用静态渐进式牵伸矫形器用于全膝关节置换术后僵硬患者康复治疗,治疗2个月后膝关节平均活动度平均增加25°,治疗满意度超过90%^[14-15]。

本次研究结果中,观察组治疗后膝关节主动活动度均显著多于对照组、治疗前($P < 0.05$),观察组治疗后2个月HSS评分均显著多于对照组、治疗前($P < 0.05$),且观察组治疗后关节活动度平均增加超过50°,进一步证实改良牵伸康复方案在改善膝关节僵硬患者关节活动度和功能状态方面优势,与以往报道结果相符^[16-18]。本次研究笔者观察到2组患者膝关节指标尽管优于治疗前,但均未达到最佳疗效,这可能与治疗时间较短有关,仍有待后续更长随访确证。此外本次研究中观察组患者膝关节主动活动度改善程度优于以往研究^[19-20],这主要与本次研究联合常规康复干预措施有关。

综上所述,改良牵伸康复方案用于下肢骨折后膝关节僵硬患者可有效缓解临床症状,提高关节互动度,并有助于改善关节功能状态。

【参考文献】

- [1] 阳庆军,汪鑫.水下牵伸,关节松动对膝关节僵硬的康复疗效观察[J].中国康复,2020,35(3):147-149.
- [2] Di Giminiani R, Giovannelli A, Capuano L, et al. Neuromuscular Strategies in Stretch-Shortening Exercises with Increasing Drop Heights: The Role of Muscle Coactivation in Leg Stiffness and Power Propulsion [J]. *Int J Environ Res Public Health*, 2020, 17(22): 8647-8652.
- [3] Ren H, Huang K, Tong P, et al. Treatment of posttraumatic patella osteomyelitis with MRSA infection and knee stiffness: a case report [J]. *BMC Surg*, 2020, 20(1): 320-327.
- [4] Yin L, Hu X, Lai Z, et al. Leg Stiffness and Vertical Stiffness of Habitual Forefoot and Rearfoot Strikers during Running [J]. *Appl Bionics Biomech*, 2020, 24(11): 340-347.
- [5] Haider IT, Simonian N, Schnitzer TJ, et al. Stiffness and Strength Predictions From Finite Element Models of the Knee are Associated with Lower-Limb Fractures After Spinal Cord Injury [J]. *Ann Biomed Eng*, 2020, 14(9): 2315-2322.
- [6] Campbell TM, Ramsay T, Trudel G, et al. Knee Flexion Contractures Are Associated with Worse Pain, Stiffness, and Function in Patients with Knee Osteoarthritis: Data from the Osteoarthritis Initiative [J]. *PMR*, 2020, 23(9): 816-822.
- [7] Shen Z, Deng Y, Peng A, et al. Modified Judet's quadricepsplasty plus patellar traction for knee stiffness after femoral fracture surgery [J]. *Int Orthop*, 2020, 24(9): 1022-1029.
- [8] Xiong L, Klemm C, Yin J, et al. Outcome of Revision Surgery for the Idiopathic Stiff Total Knee Arthroplasty [J]. *J Arthroplasty*, 2020, 9(9): 883-891.
- [9] Attard V, Li CY, Self A, et al. Quantification of intra-articular fibrosis in patients with stiff knee arthroplasties using metal-reduction MRI [J]. *Bone Joint J*, 2020, 102(10): 1331-1340.
- [10] Akl AR, Baca A, Richards J, et al. Leg and lower limb dynamic joint stiffness during different walking speeds in healthy adults [J]. *Gait Posture*, 2020, 82(10): 294-300.
- [11] Rosselin C, Denys-Mounier-Vehier N, Sturbois-Nachef N, et al. From hemiparesis to finishing a marathon: a case of stiff-knee gait treated with injections of high-dose botulinum toxin into the four heads of the quadriceps [J]. *Ann Phys Rehabil Med*, 2020, 30(9): 1877-1884.
- [12] Woods PS, Morin AA, Chen PJ, et al. Automated Indentation Demonstrates Structural Stiffness of Femoral Articular Cartilage and Temporomandibular Joint Mandibular Condylar Cartilage Is Altered in FgF2KO Mice [J]. *Cartilage*, 2020, 3(10): 1947-1955.
- [13] Bidolegui F, Pereira SP, Pires RE. Safety and efficacy of the modified Judet quadricepsplasty in patients with post-traumatic knee stiffness [J]. *Eur J Orthop Surg Traumatol*, 2020, 13(10): 319-326.
- [14] Adouni M, Mbarki R, Al Khatib F, et al. Multiscale modeling of knee ligament biomechanics [J]. *Int J Numer Method Biomed Eng*, 2020, 10(11): e3413.
- [15] Merlo A, Campanini I. Counter reply: Impact of instrumental analysis of stiff knee gait on treatment appropriateness and associated costs in stroke patients [J]. *Gait Posture*, 2020, 83(11): 230-231.
- [16] Choi YJ, Seo DK, Lee KW, et al. Results of total knee arthroplasty for painless, stiff knees [J]. *Knee Surg Relat Res*, 2020, 32(1): 61-69.
- [17] Held M, Schenck RC, Khanduja V, et al. Prioritised challenges in the management of acute knee dislocations are stiffness, obesity, treatment delays and associated limb-threatening injuries: a global consensus study [J]. *J ISAKOS*, 2021, 6(4): 193-198.
- [18] Vaish A, Vaishya R, Bhasin VB. Etiopathology and Management of Stiff Knees: A Current Concept Review [J]. *Indian J Orthop*, 2020, 55(2): 276-284.
- [19] Bidolegui F, Pereira SP, Pires RE. Safety and efficacy of the modified Judet quadricepsplasty in patients with post-traumatic knee stiffness [J]. *Eur J Orthop Surg Traumatol*, 2021, 31(3): 549-555.
- [20] Tetreault MW, Hines JT, Berry DJ, et al. Isolated tibial insert exchange in revision total knee arthroplasty: reliable and durable for wear; less so for instability, insert fracture/dissociation, or stiffness [J]. *Bone Joint J*, 2021, 103(6): 1103-1110.