

·专题:脑功能康复·

重复经颅磁刺激联合镜像疗法 对脑卒中偏瘫患者的影响

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摘要 **目的** 观察重复经颅磁刺激(rTMS)联合镜像疗法(MT)对脑卒中偏瘫患者下肢运动功能和运动诱发电位(MEP)的影响。**方法** 选择2024年2月—2025年3月蚌埠医科大学第一附属医院康复科收治的60例脑卒中偏瘫患者,采用随机数字表法将其分为MT组、rTMS组和联合组,每组20例。3组患者均接受常规康复治疗。联合组在常规康复治疗基础上接受rTMS治疗,再接受镜像治疗,rTMS刺激频率1 Hz,以90%静息运动阈值(RMT)作为刺激强度,刺激位点为健侧或患侧初级运动皮层(M1)区下肢运动热点,共600个脉冲,15 min/次,1次/d,5 d/周,共4周;镜像治疗30 min/次,1次/d,5 d/周,共4周。rTMS组在常规康复治疗基础上接受rTMS治疗,再接受假镜像治疗,rTMS治疗与联合组rTMS治疗方法一致;假镜像治疗患者镜面朝向患侧肢体,背面朝向健侧肢体,其余治疗方法同联合组镜像治疗。MT组在常规康复治疗基础上接受假rTMS治疗,再接受镜像治疗,假rTMS治疗时将线圈与头皮垂直放置,其余参数与联合组rTMS治疗方法一致;镜像治疗与联合组镜像治疗方法一致。分别于治疗前后采用Fugl-Meyer下肢运动功能评定量表(FMA-LE)评定患者运动功能;采用10米步行测试(10MWT)评定患者步行功能;采用改良Barthel指数(MBI)评定日常生活活动能力;采用磁刺激仪记录患者健侧和患侧的MEP振幅和MEP潜伏期,评估神经重塑恢复情况。**结果** ① FMA-LE、MBI评分和10MWT:与治疗前比较,3组治疗后FMA-LE和MBI评分均明显升高($P<0.05$),10MWT均明显降低($P<0.05$)。与MT组、rTMS组比较,联合组治疗后FMA-LE和MBI评分均明显更高($P<0.05$),10MWT明显更低($P<0.05$)。② MEP潜伏期和MEP振幅:与治疗前比较,3组治疗后健侧MEP潜伏期均明显升高($P<0.05$),患侧MEP潜伏期均明显降低($P<0.05$);3组健侧MEP振幅均明显降低($P<0.05$),患侧MEP振幅均明显升高($P<0.05$)。与MT组、rTMS组比较,联合组健侧MEP潜伏期和患侧MEP振幅均明显更高($P<0.05$),患侧MEP潜伏期明显更低($P<0.05$)。**结论** rTMS联合MT可有效改善脑卒中偏瘫患者下肢运动功能、日常生活活动能力和运动诱发电位。

关键词 脑卒中;偏瘫;重复经颅磁刺激;镜像疗法;下肢运动功能;运动诱发电位**引用格式:** 沈孟茹, 张子昂, 李金帼, 等. 重复经颅磁刺激联合镜像疗法对脑卒中偏瘫患者的影响[J]. 康复学报, 2026, 36(8): 553-559.

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脑卒中是全球第二大致死致残原因,其发生率和致残率逐年上升,给社会带来巨大的负担。有研究显示,70%~80%脑卒中患者会留下不同程度的肢体功能障碍,这不仅影响了患者日常生活,还大大降低了生活质量^[1]。与上肢功能障碍比较,下肢功能障碍常导致患者跌倒风险增加,社会参与程度降低,甚至可能导致终身残疾^[2-3]。因此,改善下肢功能障碍是脑卒中后重要的康复目标之一。重复经颅磁刺激(repetitive transcranial magnetic stimulation, rTMS)是一种安全无痛、非侵入性的神经调控手段,通过施加特定模式的磁场脉冲,能够有效诱导大脑神经可塑性变化,促进双侧大脑半球的功能平衡与协调,优化整体脑功能状态,改善受损的肢体运动能力^[4-5]。但单纯 rTMS 治疗缺少运动感知输入,神经重塑缺乏驱动力,疗效有限。而镜像疗法(mirror therapy, MT)是一种基于镜像视觉反馈的康复治疗手段,利用平面镜,通过移动健侧肢体,诱发患侧肢体的运动,进一步激活镜像神经元系统(mirror neuron system, MNS),增强大脑皮层兴奋性^[6]。目前, rTMS 和 MT 均已被证实对脑卒中后运动功能障碍的康复具有积极的促进作用,但是两者联合应用对卒中患者运动和平衡功能及神经可塑性可能产生的协同效应仍不明确^[7-8]。近年来,无创脑刺激与运动训练的结合被视为一种有前景的联合方案,可通过调节神经可塑性增强卒中患者的运动功能^[9]。采用低频 rTMS 与 MT 干预上肢功能障碍的脑卒中患者,结果显示 rTMS 联合 MT 可调节脑网络结构,改善脑卒中偏瘫患者大脑功能和上肢功能^[10-11]。本研究采用 rTMS 联合 MT 干预脑卒中下肢功能障碍患者,取得良好疗效。

1 临床资料

1.1 病例选择标准

1.1.1 诊断标准 符合《中国各类主要脑血管病诊

断要点 2019》^[12]有关脑卒中的诊断标准。

1.1.2 纳入标准 ① 年龄 30~75 岁。② 首次发病且为单侧,病情稳定,病程 2 周~6 个月。③ 下肢 Brunnstrom 分期 II~V 期;改良 Ashworth 量表(Modified Ashworth Scale, MAS)分级 0~2 级。④ Berg 平衡量表(Berg Balance Scale, BBS)评分^[13]41~56 分,可以保持坐位≥15 min。⑤ 简易精神状态检查(Mini-Mental State Examination, MMSE)评分≥24 分,无严重认知功能及视听障碍,能够配合治疗和评估。⑥ 患者及家属均知情同意并自愿签署知情同意书。

1.1.3 排除标准 ① 存在其他严重系统或器官性疾病,如严重心肺系统疾病。② 颅骨缺陷、下肢缺失或存在其他疾病,如下肢感染、挛缩、关节手术、骨折等。③ 有严重的认知障碍和沟通障碍等,不能配合治疗。④ 有 rTMS 治疗禁忌证,如体内有金属植入物、心脏起搏器、癫痫史等。⑤ 患侧运动诱发电位未被检出。

1.1.4 中止和脱落标准 ① 中途出现病情恶化,或出现严重不良反应。② 各种原因主动要求退出试验。

1.2 一般资料

采用 G*Power 进行样本量估算,根据查阅文献及预试验结果,设定 $\alpha=0.05$,把握度 $1-\beta=0.95$,计算出综合效应值为 0.462,总样本量为 51,考虑到 15%脱落率,纳入 60 例患者^[14]。

选择 2024 年 2 月—2025 年 3 月在蚌埠医科大学第一附属医院康复科治疗的脑卒中患者 60 例,采用随机数字表法分为 MT 组、rTMS 组和联合组,每组 20 例。3 组性别、年龄、病程、瘫痪侧、脑卒中类型等一般资料比较,差异均无统计学意义($P>0.05$),具有可比性。见表 1。本研究方案经蚌埠医科大学第一附属医院医学伦理委员会审核通过(审批号:2022KY043)。

表 1 3 组一般资料比较
Table 1 Comparison of general data in three groups

组别	例数	性别		年龄/($\bar{x}\pm s$, 岁)	病程/($\bar{x}\pm s$, 月)	瘫痪侧		脑卒中类型	
		男	女			左侧	右侧	脑梗死	脑出血
rTMS 组	20	14	6	57.15±8.27	2.73±0.66	12	8	9	11
MT 组	20	13	7	51.95±8.43	3.01±1.31	12	8	13	7
联合组	20	14	6	53.70±9.21	2.85±0.87	14	6	12	8
F/χ^2 值		0.154		1.873	0.407	0.574		1.765	
P 值		0.926		0.163	0.668	0.751		0.414	

2 方 法

2.1 治疗方法

3组患者均接受常规康复治疗,主要包括物理因子疗法、运动疗法、神经促通技术(如Bobath技术、Brunnstrom技术、PNF技术和Rood技术)、良肢位摆放等,60 min/次,针灸20 min/次,选取下肢穴位进行治疗,以足三里、阳陵泉、环跳作为核心主穴。针对不同症状进行配穴调整:若患者伴有足内翻,则加取丘墟、照海穴;肌张力过高者,采用阳陵泉穴透刺法以缓解痉挛;肌力不足者,则重用足三里、伏兔穴。1次/d,5 d/周,共持续治疗4周。治疗操作均由同一位经验丰富的康复医师完成,以保证手法的一致性和稳定性。

2.1.1 联合组 在常规康复治疗基础上接受rTMS治疗,再接受镜像治疗。

2.1.1.1 rTMS治疗 患者取舒适坐位,佩戴定位帽,下肢处于充分放松状态,使用经颅磁刺激仪(武汉依瑞德医疗设备新技术有限公司,CCY-I型)进行rTMS治疗。①确定刺激部位,采用双锥形线圈,使用单脉冲TMS,将线圈相切于大脑健侧或患侧初级运动皮层(primary motor cortex, M1)区下肢运动皮质代表区,以每5~8 s缓慢移动5 mm,观察并探寻能够诱发健侧或患侧胫骨前肌最高运动诱发电位(motor evoked potentials, MEPs)波幅的特定刺激位置,即“热点”^[15]。②记录电极放置在健侧或患侧胫骨前肌肌腹,参考电极放置在健侧或患侧胫骨前肌肌腱。用单脉冲TMS对健侧或患侧M1区下肢运动区的特定“热点”进行刺激,并从较高强度开始逐步降低刺激强度,直至找到能在连续施加的10次刺激中,至少有5条运动诱发电位波幅 $>50 \mu\text{V}$ 的最小刺激强度,即静息运动阈值(resting motor threshold, RMT)。③刺激参数设置如下:刺激频率1 Hz,以90% RMT作为刺激强度,刺激位点为健侧或患侧M1区下肢区运动热点,共600个脉冲,15 min/次,1次/d,5 d/周,共4周。治疗过程中患者取舒适坐位,嘱患者避免头颈部活动,并观察有无不良反应。

2.1.1.2 镜像治疗 患者采取坐位,在双下肢之间,垂直地面放置一平面镜,确保患者健侧肢体在镜面前,患侧肢体则在背面后,躯体稍偏向健侧,嘱患者集中注意力观察镜面中的健侧下肢运动映像,同时主动想象自己的患侧下肢正在执行与镜中映像相同的运动,并尽力尝试让患侧下肢做出与健侧一致

的动作,从近端到远端依次为髋关节屈曲、外展内收、膝关节屈伸以及踝背伸、跖屈、内外翻等,每个动作重复5次,30 min/次,1次/d,5 d/周,共4周。

2.1.2 rTMS组 在常规康复治疗基础上接受rTMS治疗,再接受假镜像治疗。

2.1.2.1 rTMS治疗 与联合组rTMS治疗方法一致。

2.1.2.2 假镜像治疗 确保患者镜面朝向患侧肢体,背面朝向健侧肢体,其余治疗方法同联合组镜像治疗。

2.1.3 MT组 在常规康复治疗基础上接受假rTMS治疗,再接受镜像治疗。

2.1.3.1 假rTMS治疗 假rTMS刺激时将线圈与头皮垂直放置,其余参数与联合组rTMS治疗方法一致。

2.1.3.2 镜像治疗 与联合组镜像治疗方法一致。

以上rTMS治疗或假rTMS治疗操作由同一名经验丰富的治疗师执行,并记录每次治疗的脉冲数。镜像治疗或假镜像治疗由固定治疗师监督,确保患者注意力集中并按要求完成动作。2种不同疗法间隔3~5 min。

2.2 观察指标

2.2.1 运动功能 采用Fugl-Meyer下肢运动功能评定量表(Fugl-Meyer Assessment of Lower Extremity scale, FMA-LE)^[16]评定患者运动功能。评定内容共17个项目,每项0~2分,最高34分。评分越高表示下肢功能越好。

2.2.2 步行功能 采用10米步行测试(10-Meter Walking Test, 10MWT)^[17]评定患者步行功能。所需时间越少表示患者步行功能越好。

2.2.3 日常生活活动能力 采用改良Barthel指数(Modified Barthel Index, MBI)^[18]评定日常生活活动能力。包括10个项目,总分100分。评分越高,表示其独立完成日常活动的能力越强。

2.2.4 神经重塑恢复情况 采用磁刺激仪记录患者健侧和患侧的MEP振幅和潜伏期,以评估神经重塑恢复情况。使用单脉冲TMS,刺激强度110% RMT,刺激部位为健侧或患侧大脑M1区下肢运动热点,记录电极放置在健侧或患侧胫骨前肌肌腹,选择5条振幅较大且重复性较佳的波形,计算其平均振幅和平均皮质潜伏期值^[19]。平均振幅升高表示皮层兴奋性增高;平均潜伏期值越大表示皮质脊髓束传导越慢、中枢运动通路损伤越严重。

2.3 统计学方法

采用 SPSS 27.0 统计软件进行数据分析。计量资料采用 Shapiro-Wilk 检验进行正态性检验,符合正态分布的以($\bar{x}\pm s$)表示,组内治疗前后比较采用配对样本 t 检验,组间比较采用单因素方差分析,组间两两比较采用 LSD- t 检验;若计量资料不符合正态分布以 $M(P_{25}, P_{75})$ 表示,组内比较采用 Wilcoxon 符号秩检验,组间比较采用 Kruskal-Wallis H 检验。计数资料用例数表示,采用 χ^2 检验。 $P<0.05$ 为差异有

统计学意义。

3 结 果

3.1 3组治疗前后FMA-LE、MBI评分和10MWT比较

与治疗前比较,3 组治疗后 FMA-LE 和 MBI 评分均明显升高($P<0.05$),10MWT 均明显降低($P<0.05$)。与 MT 组、rTMS 组比较,联合组治疗后 FMA-LE 和 MBI 评分均明显更高($P<0.05$),10MWT 明显更低($P<0.05$)。见表 2。

表 2 3组治疗前后FMA-LE、MBI评分和10MWT比较($\bar{x}\pm s$)

Table 2 Comparison of FMA-LE, MBI scores and 10MWT time in three groups before and after treatment ($\bar{x}\pm s$)					
组别	例数	时间	FMA-LE/分	MBI/分	10MWT/s
MT 组	20	治疗前	18.95 $\pm$ 4.24	45.10 $\pm$ 7.04	25.72 $\pm$ 2.05
		治疗后	22.00 $\pm$ 3.23 ¹⁾	53.24 $\pm$ 5.92 ¹⁾	22.14 $\pm$ 2.50 ¹⁾
rTMS 组	20	治疗前	19.20 $\pm$ 3.05	44.15 $\pm$ 5.12	25.00 $\pm$ 3.02
		治疗后	21.20 $\pm$ 2.51 ¹⁾	53.17 $\pm$ 3.96 ¹⁾	21.69 $\pm$ 2.54 ¹⁾
联合组	20	治疗前	18.25 $\pm$ 4.17	44.90 $\pm$ 6.06	24.99 $\pm$ 2.11
		治疗后	24.25 $\pm$ 4.29 ¹⁾²⁾³⁾	61.90 $\pm$ 5.11 ¹⁾²⁾³⁾	16.49 $\pm$ 2.12 ¹⁾²⁾³⁾

注:与治疗前比较,1) $P<0.05$;与 MT 组比较,2) $P<0.05$;与 rTMS 组比较,3) $P<0.05$ 。
Note: compared with that before treatment, 1) $P<0.05$; compared with the MT group, 2) $P<0.05$; compared with the rTMS group, 3) $P<0.05$.

3.2 3组治疗前后MEP潜伏期和MEP振幅比较

与治疗前比较,3 组治疗后健侧 MEP 潜伏期均明显升高($P<0.05$),患侧 MEP 潜伏期均明显降低($P<0.05$);3 组健侧 MEP 振幅均明显降低($P<0.05$),

患侧 MEP 振幅均明显升高($P<0.05$)。与 MT 组、rTMS 组比较,联合组健侧 MEP 潜伏期和患侧 MEP 振幅均明显更高($P<0.05$),患侧 MEP 潜伏期明显更低($P<0.05$)。见表 3。

表 3 3组治疗前后MEP潜伏期和MEP振幅比较($\bar{x}\pm s$)

Table 3 Comparison of MEP latency and amplitude in three groups before and after treatment ($\bar{x}\pm s$)						
组别	例数	时间	MEP 潜伏期/ms		MEP 振幅/mV	
			健侧	患侧	健侧	患侧
MT 组	20	治疗前	27.63 $\pm$ 2.15	34.16 $\pm$ 3.51	1.16 $\pm$ 0.31	0.54 $\pm$ 0.20
		治疗后	28.13 $\pm$ 1.98 ¹⁾	31.82 $\pm$ 2.84 ¹⁾	1.14 $\pm$ 0.30 ¹⁾	0.56 $\pm$ 0.19 ¹⁾
rTMS 组	20	治疗前	27.06 $\pm$ 2.05	34.11 $\pm$ 4.20	0.97 $\pm$ 0.55	0.52 $\pm$ 0.18
		治疗后	27.74 $\pm$ 1.92 ¹⁾	31.46 $\pm$ 3.45 ¹⁾	0.94 $\pm$ 0.54 ¹⁾	0.60 $\pm$ 0.15 ¹⁾
联合组	20	治疗前	26.48 $\pm$ 1.41	33.83 $\pm$ 3.26	1.19 $\pm$ 0.34	0.57 $\pm$ 0.17
		治疗后	29.77 $\pm$ 1.92 ¹⁾²⁾³⁾	29.53 $\pm$ 2.29 ¹⁾²⁾³⁾	1.03 $\pm$ 0.28 ¹⁾	0.84 $\pm$ 0.18 ¹⁾²⁾³⁾

注:与治疗前比较,1) $P<0.05$;与 MT 组比较,2) $P<0.05$;与 rTMS 组比较,3) $P<0.05$ 。
Note: compared with that before treatment, 1) $P<0.05$; compared with the MT group, 2) $P<0.05$; compared with the rTMS group, 3) $P<0.05$.

4 讨 论

4.1 rTMS联合MT可有效改善脑卒中患者下肢运动功能和日常生活活动能力

本研究结果显示,与 MT 组、rTMS 组比较,联合

组治疗后 FMA-LE 和 MBI 评分均明显更高,10MWT 明显更低,这提示 rTMS 联合 MT 可有效改善脑卒中患者下肢运动功能和日常生活活动能力。可能与以下因素有关:① 1 Hz 低频 rTMS 可能通过对脑卒

中患者对侧半球的抑制性刺激^[20],降低对侧半球的兴奋性和对患侧半球的胼胝体抑制作用^[21-22],患侧半球皮质脊髓兴奋性增加,恢复两侧大脑半球的兴奋性,从而改善患者的运动功能^[23]。② MT可能通过MNS,以健侧肢体的运动为重点,诱发视觉错觉促进患侧肢体的运动^[24];还可能通过丰富的感觉输入(包括视觉和体感输入)调节M1区的皮质活动,提高患者的下肢运动功能^[25]。③ 利用MT通过视觉和本体感觉输入刺激大脑皮层,构成外周刺激,而rTMS对脑损伤或脑功能区进行直接、精确的刺激,通过这种“中枢-外周”的干预^[26],rTMS激活相应的脑功能区,优化大脑局部微环境;MT训练提高感觉运动皮层的兴奋性,两者联合可能强化正性感觉输入和运动控制训练,提高神经可塑性,促进下肢功能更好地恢复,缓解下肢功能障碍对患者生活的影响,改善脑卒中患者日常生活活动能力和生活质量。这与WANG等^[27]研究结果相似。

4.2 rTMS联合MT可有效改善脑卒中患者运动诱发电位

本研究结果显示,与MT组、rTMS组比较,联合组健侧MEP潜伏期和患侧MEP振幅均明显更高,患侧MEP潜伏期明显更低。这提示rTMS联合MT可有效改善脑卒中患者运动诱发电位。可能与以下因素有关:① rTMS早期干预可使脑卒中患者出现MEP,即使MEP振幅非常小,也通常预示着更好的运动功能恢复潜力^[28]。在严重瘫痪的早期(如下肢Brunnstrom分期Ⅱ~Ⅲ期)能够诱发出MEP,哪怕振幅非常小,也通常预示着更好的运动功能恢复潜力,这表明皮质脊髓束仍然保持着结构上的连续性,为后续的神经营养和神经重组提供了基础。低频rTMS可能通过抑制脑卒中患者健侧半球的兴奋性,提高患侧半球的兴奋性,改善受损的MNS,增强MT疗效。② 在MT疗法中,脑卒中患者健侧肢体的运动以及镜像视觉反馈的作用可能激活患侧大脑的感觉皮质,提高rTMS对患侧M1区运动皮质的效果^[29]。rTMS与MT疗法相互促进,促使两侧大脑半球MEP振幅及潜伏期趋于相对平衡状态,增强脑卒中患者脑功能的重塑和下肢运动功能。③ rTMS联合MT治疗的益处可能超越了兴奋性调节,延伸至神经保护与修复层面。有研究显示,rTMS不仅能调节皮层兴奋性,还能影响胶质细胞活性,调节脑源性神经营养因子水平,促进神经微环境改善^[30-31]。本研究采用1 Hz rTMS干预可能“预调节”了神经网

络的电生理状态,改善大脑局部的免疫与代谢微环境。MT疗法则利用优化后的微环境,通过强化地使用依赖性可塑性机制,更高效地驱动功能性神经连接的可塑性。两者联合应用取得更好疗效可能与“神经微环境优化”与“功能性神经环路重塑”在时间和空间上的双重协同有关。

5 小 结

rTMS联合MT可有效改善脑卒中患者下肢运动功能、日常生活活动能力和运动诱发电位。但本研究仍存在一些不足之处,如样本量较小且来源单一,磁刺激靶点选择以及刺激参数待优化,观察时间较短未进行出院后随访,未能评估其他可能参与运动恢复的脑区(如运动前区、辅助运动区、小脑等)的功能变化。下一步还需开展多中心、大样本临床随机对照组研究,探讨不同刺激参数对治疗效果的影响,延长观察时间,并借助功能磁共振等技术进行更全面的脑网络机制探索,以期rTMS联合MT改善脑卒中后下肢功能障碍、促进脑功能重塑提供更科学的依据。

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Effects of Repetitive Transcranial Magnetic Stimulation Combined with Mirror Therapy for Patients with Post-Stroke Hemiplegia

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ABSTRACT Objective To investigate the effects of repetitive transcranial magnetic stimulation (rTMS) combined with mirror therapy (MT) on lower limb motor function and motor evoked potentials (MEP) in patients with post-stroke hemiplegia. **Methods** A total of 60 patients with post-stroke hemiplegia admitted to the Department of Rehabilitation of the First Affiliated Hospital of Bengbu Medical University from February 2024 to March 2025 were randomly assigned into MT group, rTMS group and combined group, with 20 cases in each group. All groups received conventional rehabilitation therapy. The combined group received rTMS in addition to the conventional rehabilitation therapy, followed by mirror therapy. The rTMS was delivered at a frequency of 1 Hz with stimulation intensity at 90% of the resting motor threshold (RMT), targeting the lower-limb motor hotspot of the primary motor cortex (M1) on the unaffected or affected side, totaling 600 pulses, 15 minutes per session, once daily, five days per week for four weeks. Mirror therapy was performed for 30 minutes per session, once daily, five days per week for four weeks. The rTMS group received the identical rTMS protocol as the combined group, followed by sham mirror therapy where the mirror's reflective surface faced the affected limb and its back faced the unaffected limb, while all other procedures maintained consistent with the mirror therapy in the combined group. The MT group received sham rTMS with the coil positioned perpendicularly to the scalp and all other parameters consistent with the protocol of the rTMS group, followed by the same mirror therapy with that of the combined group. Before and after treatment, Fugl-Meyer Assessment of Lower Extremity (FMA-LE) was used to assess motor function; 10-Meter Walking Test (10MWT) was used to assess walking function; Modified Barthel Index (MBI) was used to assess activities of daily living. A magnetic stimulator was used to record the amplitude and latency of motor evoked potentials (MEPs) in both the affected and unaffected sides for the assessment of neural plasticity and recovery. **Results** (1) FMA-LE, MBI scores and 10MWT: compared with those before treatment, the FMA-LE and MBI scores in all three groups increased significantly after treatment ($P<0.05$), while 10MWT decreased significantly ($P<0.05$). Compared with the MT group and the rTMS group, FMA-LE and MBI scores in the combined group were significantly higher after treatment ($P<0.05$), and 10MWT was significantly lower after treatment ($P<0.05$). (2) MEP latency and amplitude: compared with those before treatment, the MEP latency on the unaffected side in all three groups was prolonged significantly after treatment ($P<0.05$), whereas the MEP latency on the affected side shortened significantly ($P<0.05$); the MEP amplitude on the unaffected side in all three groups decreased significantly ($P<0.05$), while the MEP amplitude on the affected side increased significantly ($P<0.05$). Compared with the MT group and the rTMS group, MEP latency of the unaffected side was longer and MEP amplitude of the affected side was significantly higher in the combined group ($P<0.05$), and MEP latency on the affected side in the combined group was significantly shorter ($P<0.05$). **Conclusion** rTMS combined with MT can effectively improve lower limb motor function, activities of daily living, and motor evoked potentials in patients with post-stroke hemiplegia.

KEY WORDS stroke; hemiplegia; repetitive transcranial magnetic stimulation; mirror therapy; lower limb function; motor evoked potentials

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standard and protocol for integrated rehabilitation assessment and treatment of PSCI facilitates the wide application and standardized implementation of integrated traditional Chinese and Western medicine in PSCI rehabilitation. This technical specification clarifies the terminology and definitions related to PSCI rehabilitation assessment and treatment. Based on the International Classification of Functioning, Disability and Health (ICF), it conducts a holistic rehabilitation assessment of PSCI patients across four dimensions: body functions and structures, activities, participation, and environmental factors. Furthermore, it formulates an integrated traditional Chinese and Western medicine rehabilitation regimen, targets cognitive dysfunction, cognitive activity barriers, social participation barriers, and environmental adjustment barriers. This specification is applicable for guiding rehabilitation institutions at all levels, traditional Chinese medicine hospitals, and rehabilitation departments of general hospitals in China to provide systematic and standardized rehabilitation assessment and integrated traditional Chinese and Western medicine rehabilitation treatment for PSCI patients in the acute, recovery, and sequelae stages.

KEY WORDS stroke; post-stroke cognitive impairment (PSCI); *International Classification of Functioning, Disability and Health* (ICF); rehabilitation assessment; rehabilitation treatment; technical standard

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