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腦性麻痺兒童低阻力荷重坐站訓練之效果與坐站動作分析

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腦性麻痺兒童低阻力荷重坐站訓練之效果與坐站動作控制分析

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功能性肌力訓練為符合現代任務取向之肌力訓練方法，本研究室過去已完成具信效度之功能性肌力荷重坐/站測試（STS1RM）與訓練（LSTST），然功能性肌力訓練對腦性麻痺（CP）兒童之效果與機轉尚不清楚。目的：1)探討低阻力 LSTST 對 CP 兒童粗動作功能的療效；2)比較 CP 兒童不同阻力下 STS 活動之動作控制參數。分別進行兩個計畫以達成兩個目的。

研究方法：兩個計畫之受試者皆為 5-12 歲痙攣型雙邊麻痺兒童。第一個計畫之受試者為每週接受物理治療至少一次的 20 位兒童，根據嚴重度及年齡分層隨機分為實驗組及控制組各 10 名。實驗組經一名治療師指導在家自行進行低阻力荷重坐站訓練（20% 與 50% 1RM 阻力），每週 3 次，每次 3 套，持續 6 週，每二週重新測試 1RM 並調整其阻力；控制組則不給予荷重坐站訓練，於研究期間所有治療均維持不變。治療前後由不知兒童分組狀況之測試者評估兒童荷重坐站 1 次最大阻力(1RM)、荷重坐站肌耐力、膝伸直肌等長肌力、「粗大動作功能量表」之目標分數、行走速度及生理耗能指數等變項。第二個計畫之受試者 16 名；分別於測力板上於 100% 1RM, 20%-50%1RM 與 0%1RM 三種阻力下進行坐站動作，以其足底壓力中心軌跡之移動距離百分比為其動作控制參數。在第一計畫以獨立樣本 t 檢定分析兩組兒童荷重坐站肌耐力訓練前後的差異，以重複二維多因子變異數分析比較兩組兒童其他變項之改變，在第二計畫以無母數統計方法分析三種阻力下之動作控制參數；以單尾檢定$\alpha = 0.05$ 具顯著差異。

結果：第一計畫：經過 6 週後，訓練組兒童在荷重坐站 1RM、荷重坐站肌耐力、「粗大動作功能量表」之目標分數及生理耗能指數較控制組有顯著的進步，但訓練組並無較控制組增加更多膝伸直肌等長肌力或行走速度。第二計畫：與無阻力狀況下相比，低阻力荷重坐站動作之足底壓力中心軌跡之移動距離百分比無顯著

改變，而高阻力荷重坐站動作之足底壓力中心軌跡之移動距離百分比則顯著增加。

結論：荷重坐站阻力訓練對輕度痙攣型腦性麻痺兒童確實能增加肌力及肌耐力，且能促進站立及走/跑/跳等粗大動作功能及行走效率；動作控制參數於低阻力荷重坐站下不會改變。

關鍵字：坐站動作、阻力訓練、療效、腦性麻痺、動作控制

Effectiveness of low-loaded sit/stand strengthening program and sit/stand motor control analysis in children with cerebral palsy

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Functional muscle strengthening program are task-specificity training program that matching the current trends. The effectiveness and mechanism of functional muscle strengthening programs was still not clear. The purposes of this study were: 1) to investigate effectiveness of a functional strengthening program – loaded sit-to-stand resistance exercise with low load on the motor function in children with mild spastic diplegia, 2) to compare the motor control parameter of loaded sit-to-stand activity between different loads. Two studies were conducted to fulfill the above purposes.

Method: Children with spastic diplegia and aged 5-12 years were included in the two studies. The first study had 20 children who received regular physical therapy at lease 1 time per week. According to the severity and age, they were randomly allocated into two groups, the training group and the control group. One blind tester who did not aware the group assignment performed the following examinations before and after 6-week training. Those were one repetition maximum of the loaded sit-to-stand test (1RM), loaded sit-to-stand endurance, the isometric strength of knee extensor, goal scores of Gross Motor Function Measurement, walking velocity, and physiological cost index. The training group participated low loaded sit-to-stand resistance exercise at home, 20% and 50% 1RM, 3 sets per time, 3 times per week for 6 weeks. The control group did not receive any added program. The other treatment programs remained the same during the study period. For the second study, 15 children were included. The center of pressure (COP) excursions during sit-to-stand

activities were collected by the force plate during three loads (100%1RM, 50%1RM, and 0%1RM). The ratio of COP excursion length and distance was used as the motor control parameter. In the first test, the loaded sit-to-stand endurances of two groups were analyzed using independent t-test, and the other outcome variables were analyzed by two-way repeated ANOVA. In the second study, nonparametric statistics was used to compare the motor control parameter of different loaded situations. The alpha level was set as .05 (one-tailed).

Results: In first study, after 6 weeks, the training group has significant improvements in the loaded sit-to-stand 1RM, loaded sit-to-stand endurance, GMFM goal scores, and physiological cost index than control group. The knee extensor strength and walking velocity were not significantly different between two groups. In the second study, the COP excursion ratios of sit-to-stand activities were not significantly different between low-loaded and non-loaded situation, however, the COP excursion ratio was higher in high loaded than in the non-loaded situation.

Conclusion：The 6 weeks loaded sit-to-stand resistance exercise improves loaded sit-to-stand 1RM, loaded sit-to-stand endurance standing and walking/running/jumping function, and walking efficiency for children with mild spastic diplegia. The motor control parameter did not change during low-loaded sit-to-stand activity.

Key words: sit-to-stand, resistance exercise, effectiveness cerebral palsy, motor control