

## 以家庭為基礎的虛擬自行車訓練對痙攣型腦性麻痺兒童在肌力及骨密度的影響 Effects of home-based virtual bicycle training on muscle strength and bone density in ambulatory children with cerebral palsy

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### 摘要

本研究這是第一次使用一種新型的以家庭為基礎的虛擬自行車訓練 (hVBT) 對痙攣型腦性麻痺(cerebral palsy,CP)兒童的肌力和骨密度的影響, 研究使用一個設計良好的隨機對照試驗方式。本研究徵召 21 位可活動的痙攣型 CP 兒童, 年齡 6-12 歲, 並被隨機分配到 hVBT 組(N=10)或對照組(N=11)。於訓練前及 3 個月 hVBT 介入的量測, 包括動作功能(GMFM- 66)、腰部及下肢肌力(仰臥起坐分數和膝關節伸肌和屈肌的力矩) 和腰椎和股骨遠端的面積骨密度(aBMD)。共變數分析(ANCOVA)以訓練前表現當作共變數, 比較兩組訓練後的差異。結果顯示 hVBT 組在等速膝關節肌力(伸展肌和屈曲肌力矩)和下肢的骨密度(股骨遠端 aBMD)比對照組明顯增加; 然而, 訓練後仰臥起坐分數、GMFM- 66、及腰椎 aBMD, 則兩組間沒有差異。結論: 分析結果顯示建議此肌肉增強方案增強 CP 兒童骨質密度比動作功能訓練要好。 hVBT 方案後 12 週的兒童比對照組有更好的下肢肌力和較大的骨密度, 因此, 所建議的 hVBT 方案對增進肌力及改善下肢 aBMD 是一個有效益和效率的略策。

**關鍵字:** 腦性麻痺, 骨密度, 肌力, 虛擬實境, 家庭為基礎

### Abstract

This is the first study to assess the effects of a novel home-based virtual bicycle training (hVBT) program for children with spastic CP using a well-designed randomized controlled trial. Twenty-one ambulatory children with spastic CP, aged 6–12, were randomly assigned to the hVBT group (n=10) or control group (n=11). Outcome measures—motor function (Gross Motor Function Measure-66 (GMFM-66), muscle strength (curl-up scores and knee extensor and flexor strength) and areal bone mineral density (aBMD) of the lumbar and distal femur—were administered before and immediately after the 3-month intervention. Analysis of covariance (ANCOVA) results show that the hVBT group had greater isokinetic strength of knee muscles (measured by isokinetic torques of knee muscles) and lower-limb bone density (measured as distal femur aBMD) than the control group at post-treatment. However, cur-up scores, GMFM-66, and lumbar aBMD at post-treatment did not differ between the two groups. Conclusions: Analytical findings suggest that the muscle-strengthening program is better at enhancing bone density for children with CP than motor function training. Children after the 3-month hVBT program had better lower-limb muscle strength and greater bone density than the control group. Thus, the proposed hVBT protocol is an effective and efficient strategy for improving muscle strength and lower limb aBMD.

**Keywords:** Cerebral palsy, bone density, muscle strength, virtual reality, home-based.