1. 請簡單解釋中樞模式發生器(central pattern generator, CPG)(10%) ，並請說明如何利用中樞模式發生器的概念訓練患者行走(15%)。

2. 目前普遍認為重複性經顱磁刺激(repetitive transcranial magnetic stimulation, rTMS)是未來治療中樞神經系統疾病的一種方式。一般學者認為在1Hz以下的低頻rTMS會造成刺激區域的抑制效果；而高於1Hz的高頻rTMS會產生刺激區域的興奮效果。請以您的觀點，試說明如何應用rTMS來進行中樞神經系統疾病的患者介入。請分別以中風患者(15%)及巴金森氏症患者(10%)的應用為例說明。

3. A 76 year-old male, diagnosed with idiopathic Parkinson's disease 9 years ago and diabetes mellitus 10 years ago, is visiting your neurological physical therapy clinic today. He walks into the clinic with a stoop posture and leftward leaning trunk, shuffling gait, and tremor over his left hand, without using any assistive device. His chief complaints are difficulty with initiating gait, shuffling gait, frequent forward falls, and progressive forward and leftward trunk leaning as he walks for over 100 meters. His last serious fall happened 8 months ago, which caused a compression fracture at L2. He did not receive any invasive medical procedures for treating the compression fracture and his back pain has subsided completely. He is taking L-dopa medication three times a day and feels end-of-dose wearing off phenomenon often.

   Please follow the **client management model** and plan your **examination, evaluation, diagnosis, prognosis (including plan of care) and intervention steps,** as well as the **outcome measures**, for the assessment and treatment of this patient. Please plan as comprehensively (e.g., you have to explain what data of medical history you would like to retrieve from the patient and the charts, what examinations are to be performed, etc.) and as specific (to the disease and problems of the patients) as possible, and explain why you have such plans. (25%)

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4. After carefully reading the following abstracts (A-C) of three articles and their associated tables/figures about high intensity aerobic interval training (AIT), please discuss the **feasibility, benefits, and possible adverse events** associated with this type of training in patients with chronic stroke. (15%) If you were to conduct a randomized controlled clinical trial to compare the efficacy of high intensity AIT versus moderate-intensity continuous training (MICT) on walking capacity of patients with chronic stroke, how would you design your study? Please lay out your design as detailed and specific as possible. For example, your design needs to include subjects of interest, criteria of subject inclusion/exclusion, intervention protocols, independent and dependent measures, etc. (10%)

(A) Askim T, Dahl AE, Aamot IL, Hokstad A, Helbostad J, Indredavik B. High-intensity aerobic interval training for patients 3-9 months after stroke: a feasibility study. Physiother Res Int 2014;19:129-139.

BACKGROUND AND PURPOSE: High-intensity aerobic interval training (AIT) has shown to be beneficial in patients with cardiac and pulmonary diseases. Presumably, patients with stroke also benefit from such treatment. However, the feasibility and potential efficacy of high-intensity AIT should be investigated for patients early after stroke. **METHODS:** This was a single-group, pre-test-post-test, intervention study. The intervention consisted of a 6-week high-intensity AIT programme, performed twice a week. The AIT comprised 4 x 4-minute intervals, at 85-95% of peak heart rate, interrupted by 3-minute active breaks. Adherence to the protocol, compliance and adverse events were registered to assess feasibility. Cardiorespiratory fitness and functional outcomes were assessed before and after the intervention and at 6 and 12 weeks follow-up. **RESULTS:** Ten men and five women (mean age 70.0 +/- 7.7; range 61-85 years) with mild to moderate stroke were included, 3-9 months after onset. One patient was diagnosed with cancer during follow-up. There were three minor events, but no serious adverse events occurred. All patients accomplished all training sessions and reached the 85% intensity level, except one patient who discontinued the last session. The mean peak oxygen uptake showed no significant improvement from pre-treatment, 28.7 +/- 3.8 ml kg(-1) min(-1), to post-treatment, 29.6 +/- 3.6 ml kg(-1) min(-1), $p = 0.189$, whereas the mean 6-minute walk test improved from 410.7 +/- 101.4 m to 461.0 +/- 99.6 m, $p = 0.001$, and the median (interquartile range) Rivermead Motor Assessment Scale improved from 12.0 (11.0-13.0) to 13.0 (11.0-13.0) points, $p = 0.100$. These improvements continued after the intervention was concluded. **CONCLUSIONS:** This study has shown that high-intensity AIT is feasible for a selected group of stroke patients. However, the training should be accomplished in line with the American College of Sports Medicine guidelines for high-risk populations to ensure safety. The participants achieved a clinically highly significant improvement in walking distance. This intervention should be tested out in a randomized controlled trial to assess if it is superior to other interventions.

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Table 2. Exercise intensity presented as percentage of peak heart rate and rating on Borg's scale during the last 2 minutes of each training session ($n = 14$)

Training session	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	10th	11th	12th
	Median (IQR)											
HR	89.8 (85.9–92.0)	91.5 (88.3–94.5)	92.6 (87.2–94.0)	90.8 (88.0–92.3)	90.7 (88.4–92.4)	90.4 (85.7–95.9)	90.5 (86.1–93.5)	91.4 (90.0–92.4)	91.0 (89.0–93.0)	91.0 (89.6–92.0)	89.7 (88.1–93.3)	89.9 (88.5–92.4)
Borg's scale	16.5 (14.6–17.6)	16.3 (13.8–17.6)	17.0 (14.9–17.5)	16.3 (14.8–18.1)	17.0 (14.0–17.5)	17.0 (13.0–17.6)	17.0 (13.8–17.5)	16.3 (13.0–17.6)	16.0 (13.0–17.6)	16.5 (13.8–17.5)	16.8 (14.5–17.5)	17.5 (15.0–18.0)

IQR = interquartile range; HR = heart rate.
Data were missing from one participant on session 12.

Table 3. Treadmill test and 6-minute walk test results

	Pre-treatment ($n = 14$)	Post-treatment ($n = 14$)	6 weeks follow-up ($n = 14$)	12 weeks follow-up ($n = 14$)	Overall change	Change from pre-treatment to post-treatment
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	p-value*	p-value†
VO_{2peak}						
ml kg^{-1} min^{-1}	28.7 (3.8)	29.6 (3.6)	29.9 (3.4)	30.3 (3.7)	0.14	0.19
l min^{-1}	2.20 (0.5)	2.27 (0.50)	2.31 (0.53)	2.34 (0.53)	0.08	0.19
RER-value	1.09 (0.07)	1.11 (0.05)	1.09 (0.04)	1.10 (0.05)	0.53	0.31
HR_{peak}	149.4 (15.3)	149.8 (15.6)	148.6 (14.1)	150.9 (13.3)	0.66	0.83
6MWT (m)	410.7 (101.4)	461.0 (99.6)	464.8 (93.0)	479.4 (93.9)	≤0.001	≤0.001
	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	p-value‡	p-value§
Borg's scale	16.0 (15.0–18.0)	18.0 (14.5–19.0)	18.5 (17.0–19.0)	18.0 (16.0–19.0)	0.48	0.04

SD = standard deviation; IQR = inter quartile range; VO_2peak = peak oxygen uptake; RER = respiratory exchange ratio; HR = heart rate; 6MWT = six-minute walk test.
*General Linear Model Repeated Measure analysis.
†Pairwise analysis of pre-treatment score and post-treatment score, adjusted for multiple comparisons.
‡Friedman's Two-Way Analysis of Variance by Ranks.
§Wilcoxon signed-rank test.

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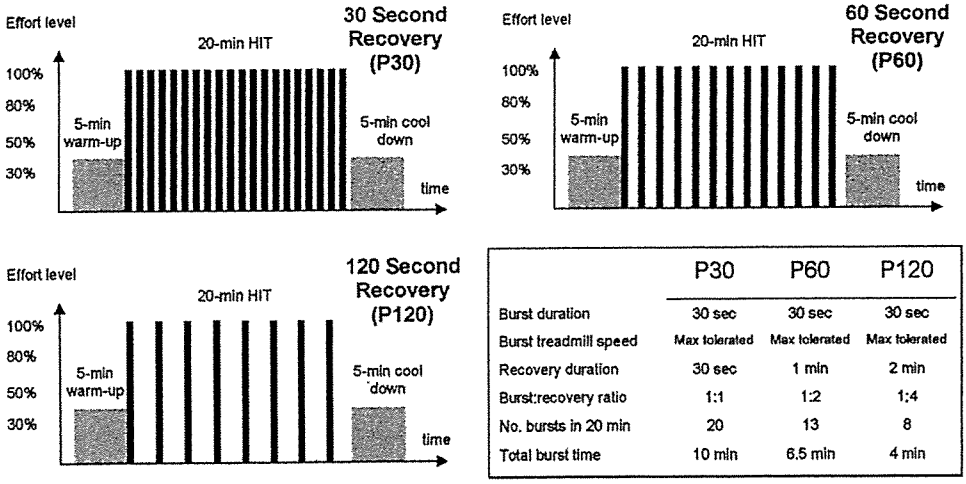
(B) Boyne P, Dunning K, Carl D, Gerson M, Khoury J, Kissela B. Within-session responses to high-intensity interval training in chronic stroke. Med Sci Sports Exerc 2015;47:476-484..

Poststroke hemiparesis often leads to a vicious cycle of limited activity, deconditioning, and poor cardiovascular health. Accumulating evidence suggests that exercise intensity is a critical factor determining gains in aerobic capacity, cardiovascular protection, and functional recovery after stroke. High-intensity interval training (HIT) is a strategy that augments exercise intensity using bursts of concentrated effort alternated with recovery periods. However, there was previously no stroke-specific evidence to guide HIT protocol selection. PURPOSE: This study aimed to compare within-session exercise responses among three different HIT protocols for persons with chronic (>6 months after) stroke. METHODS: Nineteen ambulatory persons with chronic stroke performed three different 1-d HIT sessions in a randomized order, approximately 1 wk apart. HIT involved repeated 30-s bursts of treadmill walking at maximum tolerated speed, alternated with rest periods. The three HIT protocols were different on the basis of the length of the rest periods, as follows: 30 s (P30), 60 s (P60), or 120 s (P120). Exercise tolerance, oxygen uptake (V O2), HR, peak treadmill speed, and step count were measured. RESULTS: P30 achieved the highest mean V O2, HR, and step count but with reduced exercise tolerance and lower treadmill speed than P60 or P120 (P30: 70.9% V O2peak, 76.1% HR reserve (HRR), 1619 steps, 1.03 m.s(-1); P60: 63.3% V O2peak, 63.1% HRR, 1370 steps, 1.13 m.s(-1); P120: 47.5% V O2peak, 46.3% HRR, 1091 steps, 1.10 m.s(-1)). P60 achieved treadmill speed and exercise tolerance similar to those in P120, with higher mean V O2, HR, and step count. CONCLUSIONS: For treadmill HIT in chronic stroke, a combination of P30 and P60 may optimize aerobic intensity, treadmill speed, and stepping repetition, potentially leading to greater improvements in aerobic capacity and gait outcomes in future studies.



	P30	P60	P120
Burst duration	30 sec	30 sec	30 sec
Burst treadmill speed	Max tolerated	Max tolerated	Max tolerated
Recovery duration	30 sec	1 min	2 min
Burst:recovery ratio	1:1	1:2	1:4
No. bursts in 20 min	20	13	8
Total burst time	10 min	6.5 min	4 min

FIGURE 1—HIT protocol schematics.

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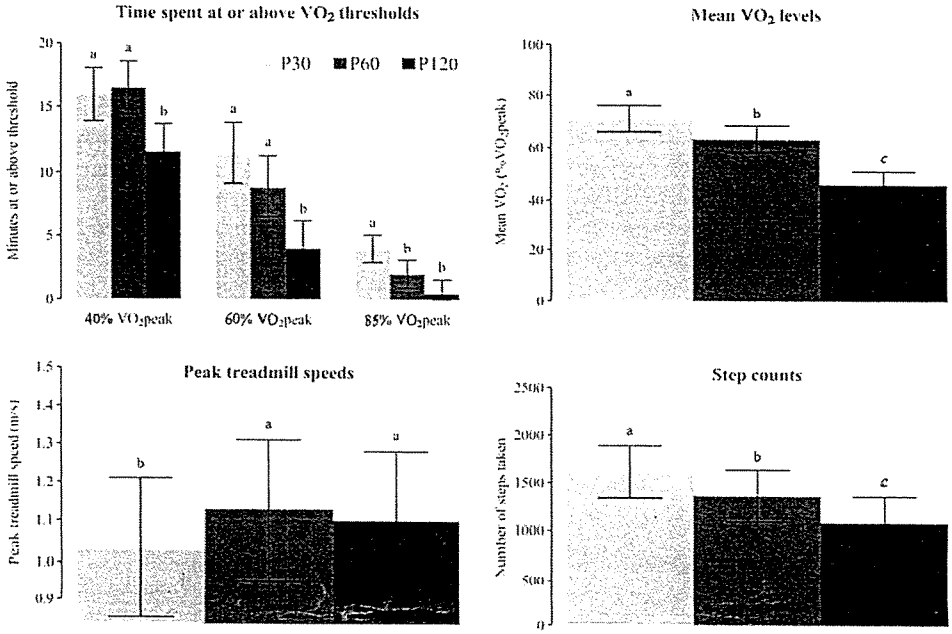

FIGURE 3—Differences in mean oxygen consumption ($\dot{V}O_2$), treadmill speed, and step count between protocols ($n = 18$). *Error bars* represent 95% confidence intervals for the least square means. *Nonmatching letters* (*a*, *b*, *c*) indicate a significant ($P < 0.05$) difference between protocols after Tukey–Kramer adjustment for multiple comparisons. In the bottom left, treadmill speed graph, the mean starting speed for each protocol (0.84 m·s^{-1}) was used as the base of the *y*-axis.

(C) Ramos JS, Dalleck LC, Tjonna AE, Beetham KS, Coombes JS. The impact of high-intensity interval training versus moderate-intensity continuous training on vascular function: a systematic review and meta-analysis. Sports Med 2015;45:679-692.

BACKGROUND: Vascular dysfunction is a precursor to the atherosclerotic cascade, significantly increasing susceptibility to cardiovascular events such as myocardial infarction or stroke. Previous studies have revealed a strong relationship between vascular function and cardiorespiratory fitness (CRF). Thus, since high-intensity interval training (HIIT) is a potent method of improving CRF, several small randomized trials have investigated the impact on vascular function of HIIT relative to moderate-intensity continuous training (MICT). OBJECTIVE: The aim of this study was to systematically review the evidence and quantify the impact on vascular function of HIIT compared with MICT. **METHODS:** Three electronic databases (PubMed, Embase, and MEDLINE) were searched (until May 2014) for randomized trials comparing the effect of at least 2 weeks of HIIT and MICT on vascular function. HIIT protocols involved predominantly aerobic exercise at a high intensity, interspersed with active or passive recovery periods. We performed a meta-analysis to compare the mean difference in the change in vascular function assessed via brachial artery flow-mediated dilation (FMD) from baseline to post-intervention between HIIT and MICT. The impact of HIIT versus MICT on CRF, traditional cardiovascular disease (CVD) risk

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factors, and biomarkers associated with vascular function (oxidative stress, inflammation, and insulin resistance) was also reviewed across included studies. **RESULTS:** Seven randomized trials, including 182 patients, met the eligibility criteria and were included in the meta-analysis. A commonly used HIIT prescription was four intervals of 4 min (4 x 4 HIIT) at 85-95% of maximum or peak heart rate (HRmax/peak), interspersed with 3 min of active recovery at 60-70% HRmax/peak, three times per week for 12-16 weeks. Brachial artery FMD improved by 4.31 and 2.15% following HIIT and MICT, respectively. This resulted in a significant ($p < 0.05$) mean difference of 2.26%. HIIT also had a greater tendency than MICT to induce positive effects on secondary outcome measures, including CRF, traditional CVD risk factors, oxidative stress, inflammation, and insulin sensitivity. **CONCLUSION:** HIIT is more effective at improving brachial artery vascular function than MICT, perhaps due to its tendency to positively influence CRF, traditional CVD risk factors, oxidative stress, inflammation, and insulin sensitivity. However, the variability in the secondary outcome measures, coupled with the small sample sizes in these studies, limits this finding. Nonetheless, this review suggests that 4 x 4 HIIT, three times per week for at least 12 weeks, is a powerful form of exercise to enhance vascular function.

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