

## Effects of music therapy on heart rate variability as surrogate parameter for pain and stress - a pilot study

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### Background and aim

Music therapy (MT) is widely used as non-medical treatment in palliative care. Its known effects are mainly reduction in pain perception and increase in well-being and relaxation, assessed by evaluation of the patients' subjective perception. Analysis of HF and LF (low/high frequency domain of heart rate variability, HRV) gives insight into autonomic regulation, which might serve as surrogate parameter for symptoms like pain and anxiety in the evaluation of music therapy.

### Methods

N = 18 healthy subjects (9 female, age 19-28) were continuously recorded by 6-channel ECG. Cardiovascular response and activation of the autonomic nervous system were induced by cold pressure test (CPT). Every test subject received 3 consecutive CPT. Hand immersion into ice water was 2 minutes. A music therapist played on an instrument previously chosen by the volunteer (monochord, sansula or ocean drum). The music intervention started 2 min before CPT and ended after 8 min at either the 2<sup>nd</sup> or 3<sup>rd</sup> CPT in a cross-over design. Data were analysed with the statistics software SPSS.



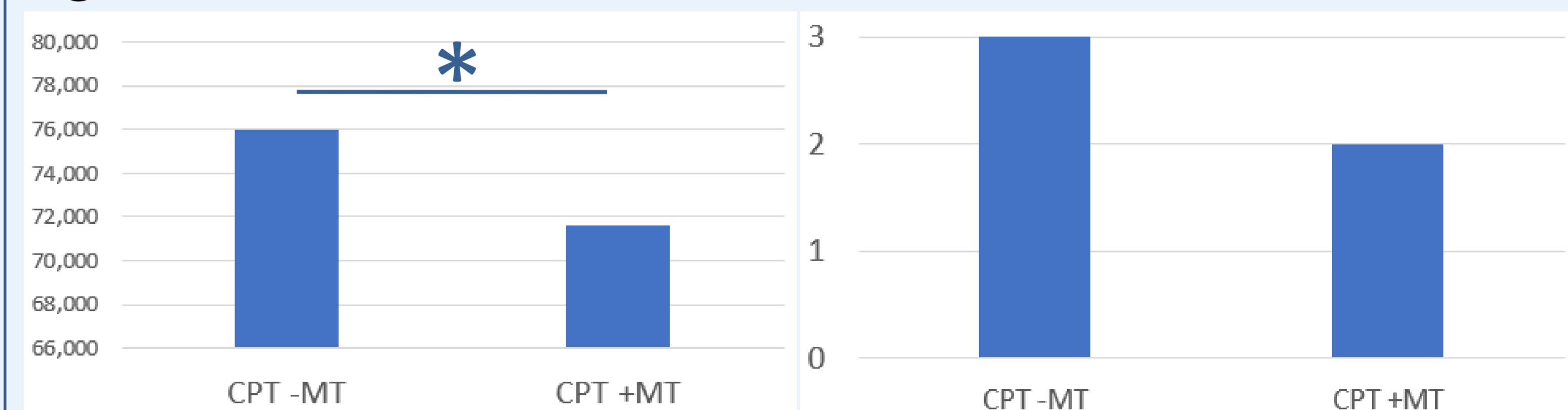
**Figure 1**  
Showing study set-up. Music therapist to the right of the volunteer, CPT to the left as well as Gold-standard validation comprising ECG, beat-to-beat bloodpressure and total peripheral resistance.

### Results

Verification of CPT procedure: heart rate increased significantly ( $p=.007$ ) during CPT and decreased again ( $p=.002$ ) during the recovery phase.

Pain was reduced by music therapy intervention (MTI, fig. 2)

**Figure 2**

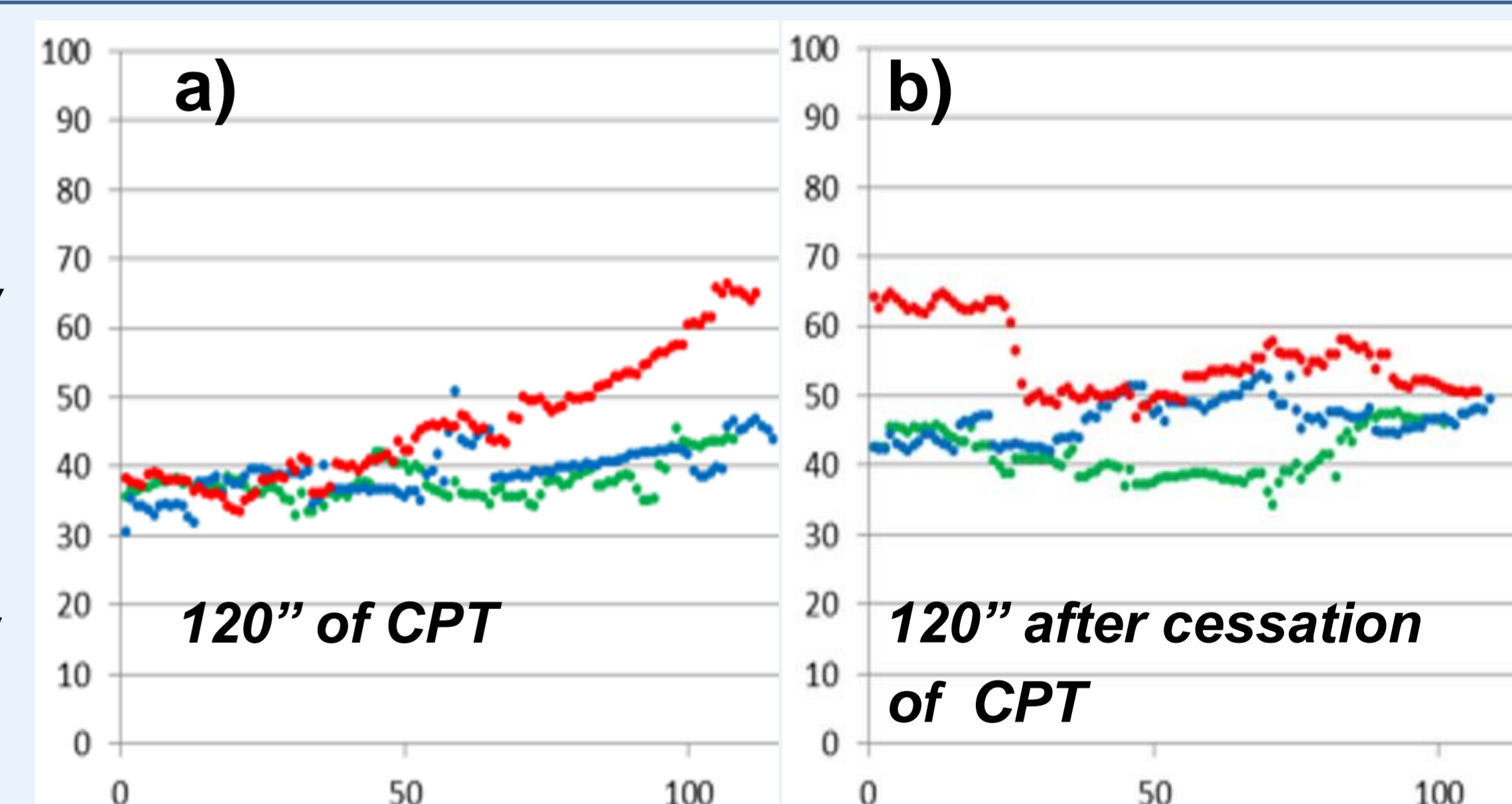


**Left hand graph shows pain intensity by visual analogue scale (VAS, 100mm) with (+MT) and without (-MT) music therapy. A reduction in pain occurred: CPT -MT  $76.0 \pm 7.8$ , (mean  $\pm$  S.E.M.) CPT +MT  $71.6 \pm 4.4$ ;  $p= .047$  (paired  $t$  test, 2-sided). Right hand graph shows effect of MT on pain reported by 4-point Likert scale (0= no pain, 1 = slight pain, 2 = moderate pain, 3= severe pain)**

Group comparison of HRV showed no significant change with / without MTI, although individual trajectories of HRV show an effect by MTI (fig 3).

**Figure 3**

Depicted is the parasympathetic domain of HRV (normalized high frequency domain, Hfnu). Green shows HFnu for the 1<sup>st</sup> CPT, blue: CPT without MT, and red: CPT with MT.



**The test subject's HFnu shows an increase of parasympathetic activity with MT (elevation of the red line) in contrast to CPT without MT (blue as well as green line) suggesting a reduction in negative validity of CPT by MT.**

### Conclusion

- In CPT as a pain model we find higher vagal activity (HF) and lower sympathetic activity (LF/HF) with MT compared to without
- MT reduces both the priming effect, i.e. expectation of pain directly before CPT after previous CPT, and pain intensity during CPT.
- Although group effects did not reach statistical significance with the current sample size, HRV analysis might be used in palliative care patients to evaluate non-medical approaches, especially if used in conjunction with psychometric data.