

# ANALGESIC EFFECTS OF MONOPHASIC AND BIPHASIC TENS WITH TWO DIFFERENT PHASE DURATIONS ON COLD-INDUCED PAIN IN NORMAL SUBJECTS

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## BACKGROUND

Transcutaneous electrical nerve stimulation (TENS) is widely used with analgesic purposes in physical therapy. Its way of working depends on its characteristics, producing analgesia by gate control or beta-endorphins liberation.

## PURPOSE

To evaluate the analgesic effects of monophasic and biphasic TENS, with two different phase duration (100 and 200 us), on cold-induced pain in normal subjects.

## METHODS

The sample was composed of normal pain-free subjects, between 18 to 35 years old, without previous experience with electrotherapy. The initial n was 100. The 84 subjects who met the inclusion criteria were divided into 5 groups (G1=19; G2=16; G3=18; G4=15; G5=16).

For the therapy, an electrical stimulator (trademark Globus, model Activa 600 Pro) was used, with carbon rubber electrodes (8.5 cm x 5 cm) placed on the forearm. The electrodes were coupled with a wet cloth. Each group received one protocol:

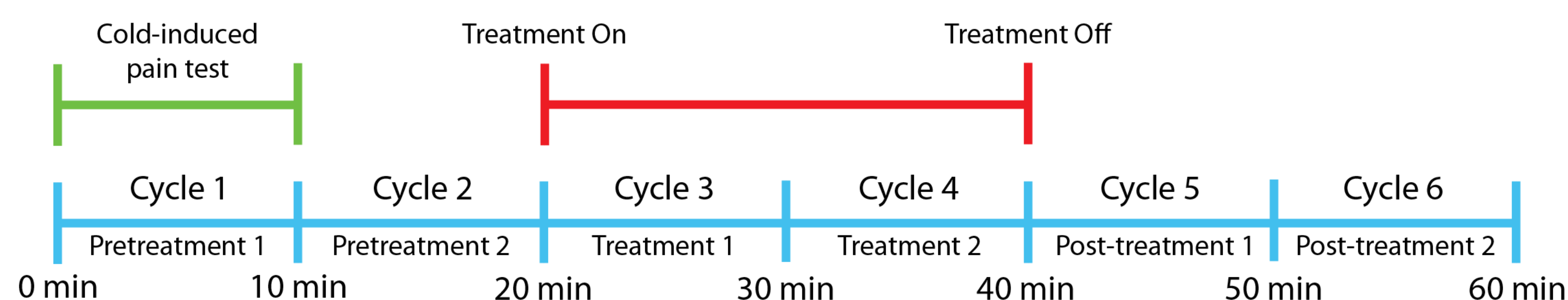
- G1: 90 Hz, 100 us of phase duration, biphasic waveform.
- G2: 90 Hz, 100 us of phase duration, monophasic waveform.
- G3: 90 Hz, 200 us of phase duration, biphasic waveform.
- G4: 90 Hz, 200 us of phase duration, monophasic waveform.
- G5: Placebo.

For pain induction, the cold model was used. The Visual Analogue Scale (VAS) was utilized to quantify pain. The subjects received six cycles of 10 minutes each:

- Cycle 1: Right hand immersion in warm water (37°C) during 5 minutes. Immersion in cold water (0°C). When the subject first sensed pain, they said "pain" and sustained the hand another 30 seconds under the water. Then, the subject answered the VAS and rested up to complete the cycle.
- Cycle 2: As the previous one, with the equipment paused.
- Cycle 3: As the previous one, with the equipment emitting the corresponding protocol.
- Cycle 4: As the previous one. At the end of this cycle, the equipment was paused.
- Cycle 5 and 6: As cycle one, without any emission.



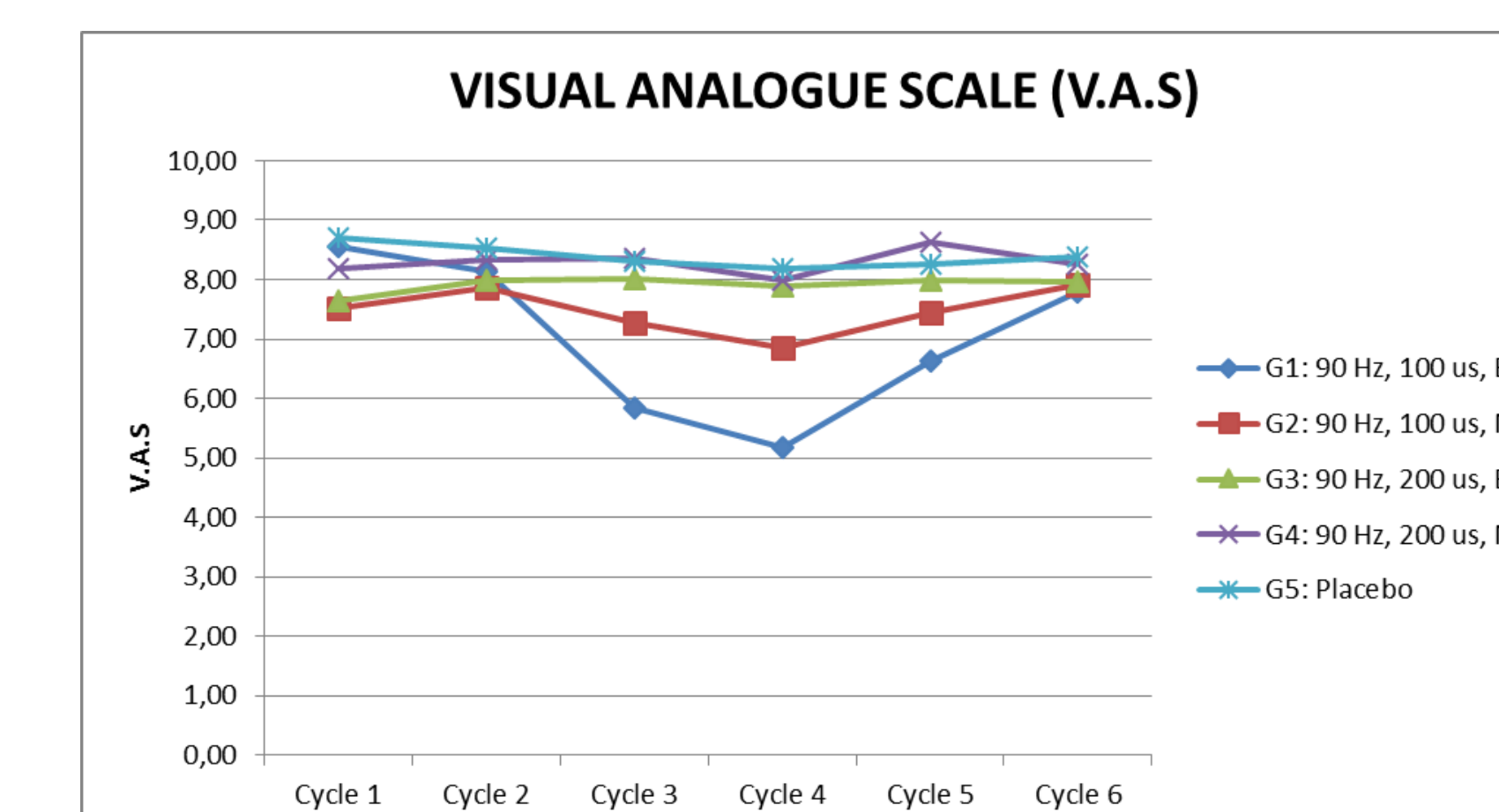
The obtained data was examined with repeated measures analysis of variance (ANOVA).



## RESULTS

In Cycle 1, G1 vs. G2 and G2 vs. placebo, the difference was significant ( $P < 0.05$ ). In Cycle 3, G1 vs. G3, G1 vs. G4, G1 vs. placebo, the difference was significant ( $P < 0.001$ ). In Cycle 4, G1 vs. G2, G1 vs. G3, G1 vs. G4, G1 vs. placebo, the difference was very significant ( $P < 0.001$ ). In Cycle 5, G1 vs. G3, G1 vs. G4, G1 vs. placebo, the difference was significant ( $P < 0.05$ ). The analysis of all the other comparisons between groups was not significant.

STATISTICAL ANALYSIS - VISUAL ANALOGUE SCALE (V.A.S)						
COMPARISON	CYCLE 1	CYCLE 2	CYCLE 3	CYCLE 4	CYCLE 5	CYCLE 6
G1 vs. G2	$P < 0.05$	ns	ns	$P < 0.001$	ns	ns
G1 vs. G3	ns	ns	$P < 0.001$	$P < 0.001$	$P < 0.05$	ns
G1 vs. G4	ns	ns	$P < 0.001$	$P < 0.001$	$P < 0.05$	ns
G1 vs. Placebo	ns	ns	$P < 0.001$	$P < 0.001$	$P < 0.05$	ns
G2 vs. G3	ns	ns	ns	ns	ns	ns
G2 vs. G4	ns	ns	ns	ns	ns	ns
G2 vs. Placebo	$P < 0.05$	ns	ns	ns	ns	ns
G3 vs. G4	ns	ns	ns	ns	ns	ns
G3 vs. Placebo	ns	ns	ns	ns	ns	ns
G4 vs. Placebo	ns	ns	ns	ns	ns	ns



## CONCLUSION (S)

The results show that the most effective waveform for pain treatment, in the case of cold induced pain model, is the biphasic symmetrical with 100 us of phase duration. More investigations are needed with other models to provide more support.

## IMPLICATIONS

TENS is one of the most used therapies for analgesia. This research provides evidence that biphasic symmetrical TENS may produce better clinical results. The acquisition of low-cost equipment with monophasic waveform is not recommended. The best phase duration is 100 us, so a device with variable phase width is the most suitable choice.

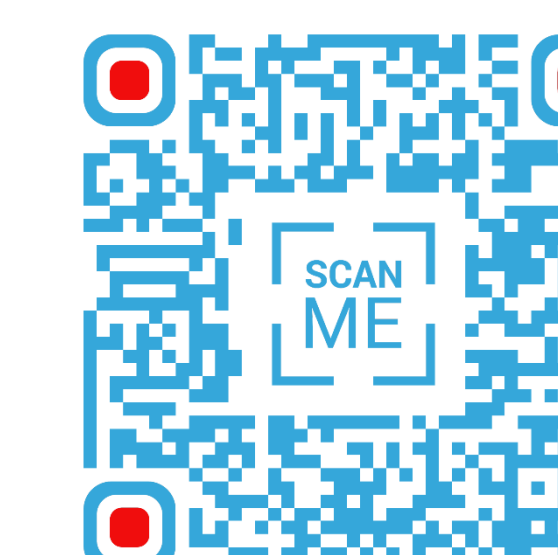
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- **Funding acknowledgements:** The author(s) received no financial support for the research and/or authorship of this article.
- **Ethics approval:** Ethics committee of Universidad Maimónides has approved this work (Res. 2010/0086).

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