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Effects of a Percussive Massage and Dynamic Stretching Warm-up on Completion Times Between Two 100-yard Freestyle Sprints in Collegiate Swimmers

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Abstract

Swimming is a sport that often requires multiple events to be completed in a short-time frame. Breaks between races have the potential to negatively impact subsequent performances, causing athletes to resort to out-of-water warm-up methods. To date, no research has been conducted to determine the effectiveness of using a percussive massage gun (PMG) as a warm-up tool between races. This study evaluated percussive massage and dynamic stretching (DS) as a warm-up by determining impact on completion time between two 100-y freestyle sprints compared to passive recovery (NT) in collegiate swimmers. It was hypothesized that PMG and DS would lead to a significant decrease in completion time compared to NT, and that PMG would elicit the greatest decrease in completion time overall. Over three sessions, participants (n=12) were counterbalanced across interventions, receiving the treatment between two sprints. Contrary to the initial hypothesis, no significant differences were noted when comparing completion times before and after treatment ($p = 0.78$). DS was the only intervention that led to decreased times post-treatment (pre: 57.33 ± 1.30 sec, post: 56.97 ± 1.33 sec), but this difference was not considered significant. Rating of perceived exertion (RPE) was assessed immediately after each swim and was significantly different between the 1st and 2nd swims in the PMG condition (pre: 17.25 ± 0.35 , post: 16.08 ± 0.45 , $p = 0.004$). In addition, a visual analog scale (VAS) determined that subjective discomfort prior to the second swim was lower following PMG compared to DS (PMG: 21.22 ± 6.05 mm, DS: 41.59 ± 5.16 mm, $p = 0.048$). The results suggest that although the athletes didn't swim faster, they felt better with PMG use. However, there is minimal support that PMG as a warm-up technique has any significant impact on improvement in swim times compared to other methods.

Introduction

- Due to the nature of competitive swimming, swimmers often experience breaks in between events
 - The duration of these breaks is not always known
- Pool space for a warm-up is not guaranteed
- Time spent resting after a warm-up has been shown to decrease swim performance (West et al., 2012)
- Percussive massage guns have typically been used as a post-exercise treatment tool, rather than a warm-up tool
- Massage guns are often chosen as a method of recovery for athletes due to their convenience and ease
- Percussive therapy has been shown to increase flexibility, as well as range of motion (Lu et al., 2019, Sams et al., 2023), and has also shown to increase blood flow to exercised muscles (Koeda et al., 2003).
 - These effects may not last long after use
- Dynamic stretching has been a common method of warm-up in sport for many years, and the effects of dynamic stretching have been heavily studied
 - Dynamic stretching has been reported to lead to increases in power and agility (Turki et al., 2012), as well as increases in flexibility, range of motion, and muscle strength (Iwata et al., 2019)
- A percussive massage gun could be a low-effort and quick alternative to a dynamic stretching routine
- This study is unique in that it evaluates the effectiveness of a percussive massage gun as a warm-up tool, instead of a treatment tool, and it has not previously been compared to dynamic stretching between sprints in swimmers.

Purpose

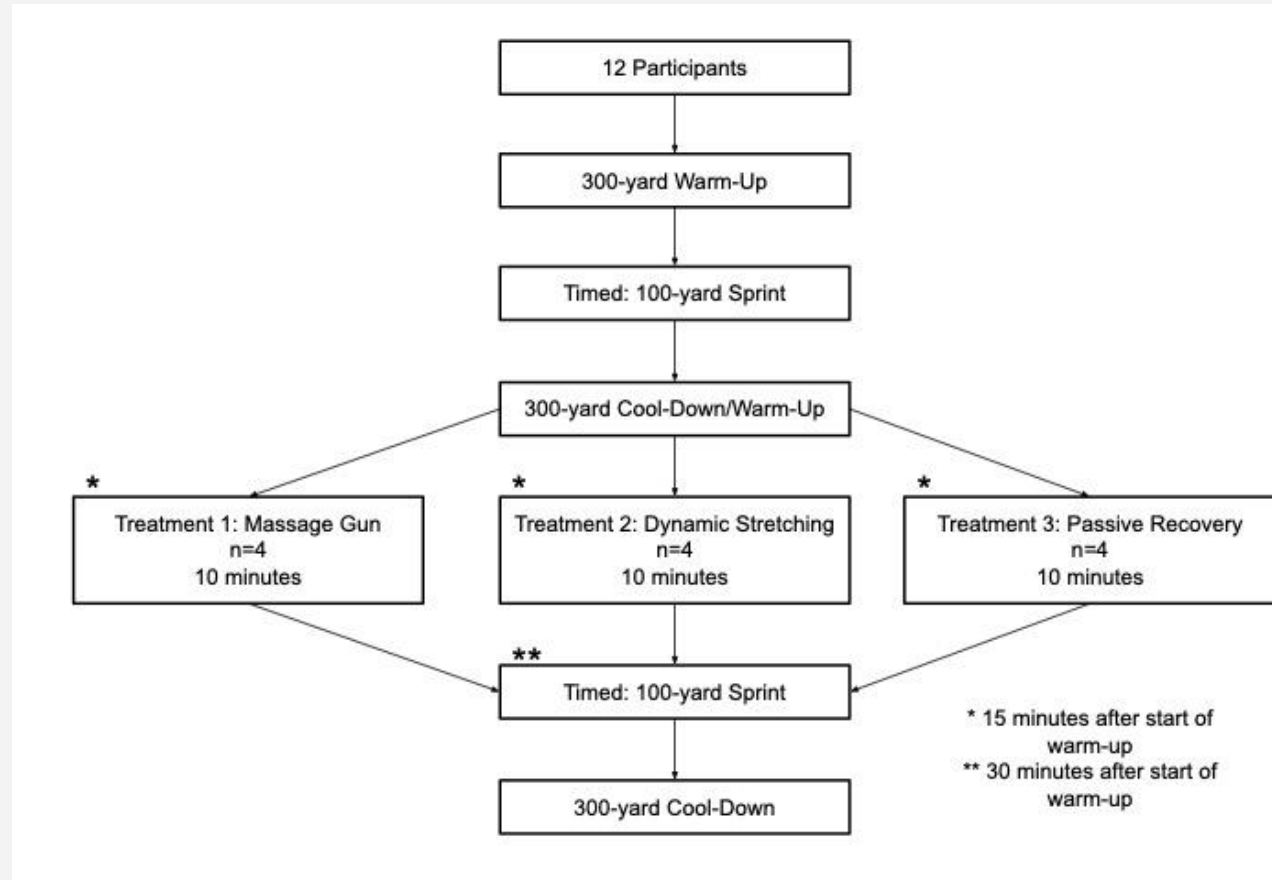
This study was designed to evaluate the effectiveness of a percussive massage gun (PMG) and dynamic stretching (DS) as a 10 minute treatment between two 100-y freestyle sprints by determining their impact on completion time compared to passive recovery (NT) in collegiate swimmers.

Methods

Subjects:

- Current members of the Hope College Swim team (male n=6, female n=6)
- Counterbalanced each day across three treatment groups (PMG, DS, NT)

Experimental Design



Testing Schedule



Massage Gun: PMG

- Hyperice Hypervolt 2 Pro
- Traps/Lats
- Soft-cushion
- Glutes, Hamstrings, Quads
- Ball attachment



Dynamic Stretching: DM

- Forward arm circles - 1 minute
- Bent over lateral arm swings: 30 seconds
- RIGHT fwd/back leg swings: 30 seconds
- LEFT fwd/back leg swings: 30 seconds
- RIGHT frontal plane leg swings: 30 seconds
- LEFT frontal plane leg swings: 30 seconds
- Backwards arm circles - 1 minute
- 90/90 stretch: 1 minute
- RIGHT thread the needle: 1 minute
- LEFT thread the needle: 1 minute

No Treatment: NT

- Participants sat in chair at poolside
- A towel was allowed
- Participants were instructed to have minimal movement
- No other activity

Assessments

Completion Time -

After first and second 100-y sprint

RPE -

After first and second 100-y sprint

VAS -

Discomfort: post-intervention
Stiffness: prior to second 100-y swim

HR -

Before, during, and after 100-y sprints

Results

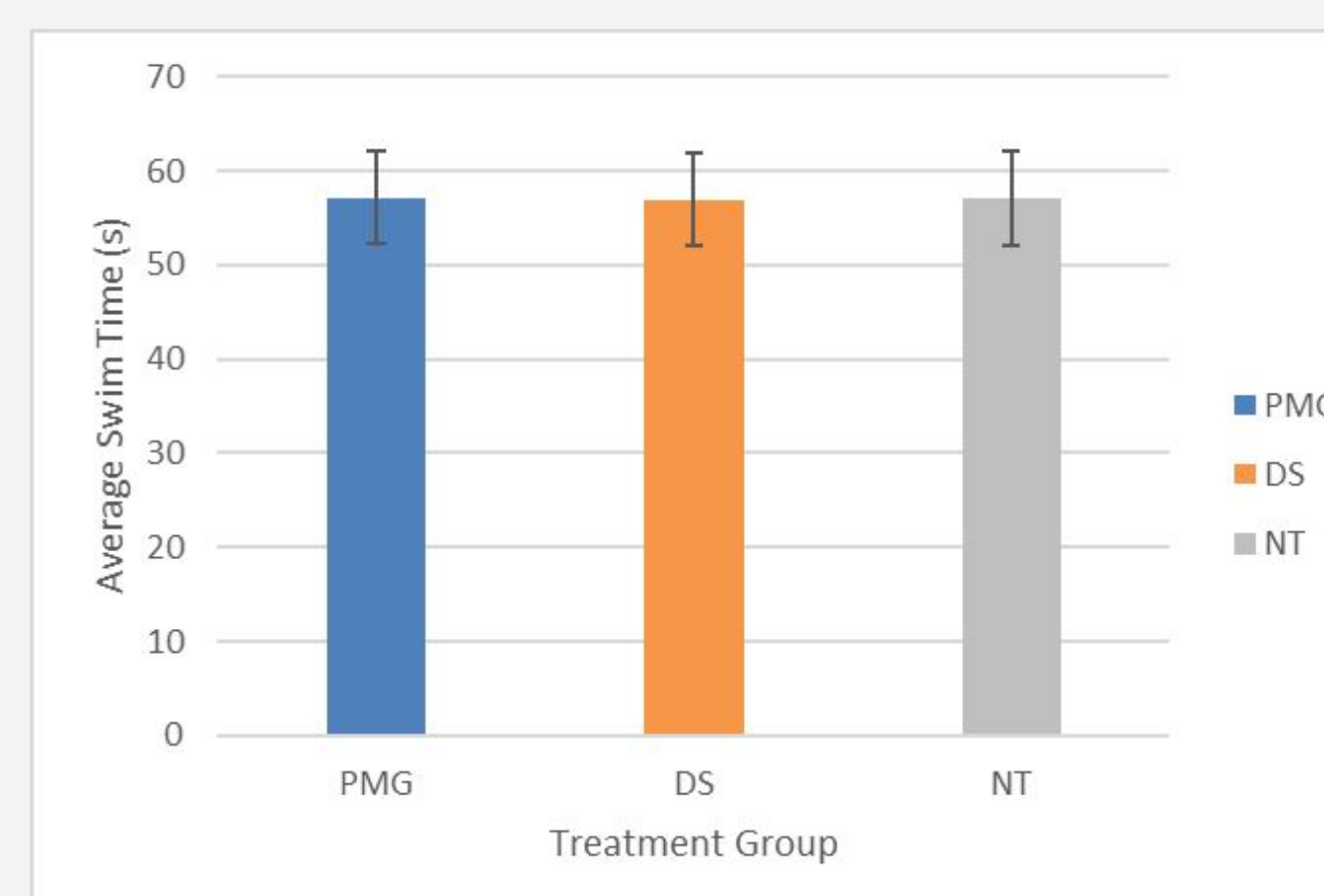


Figure 1. 2nd 100-y Freestyle Swim Times Across Treatments

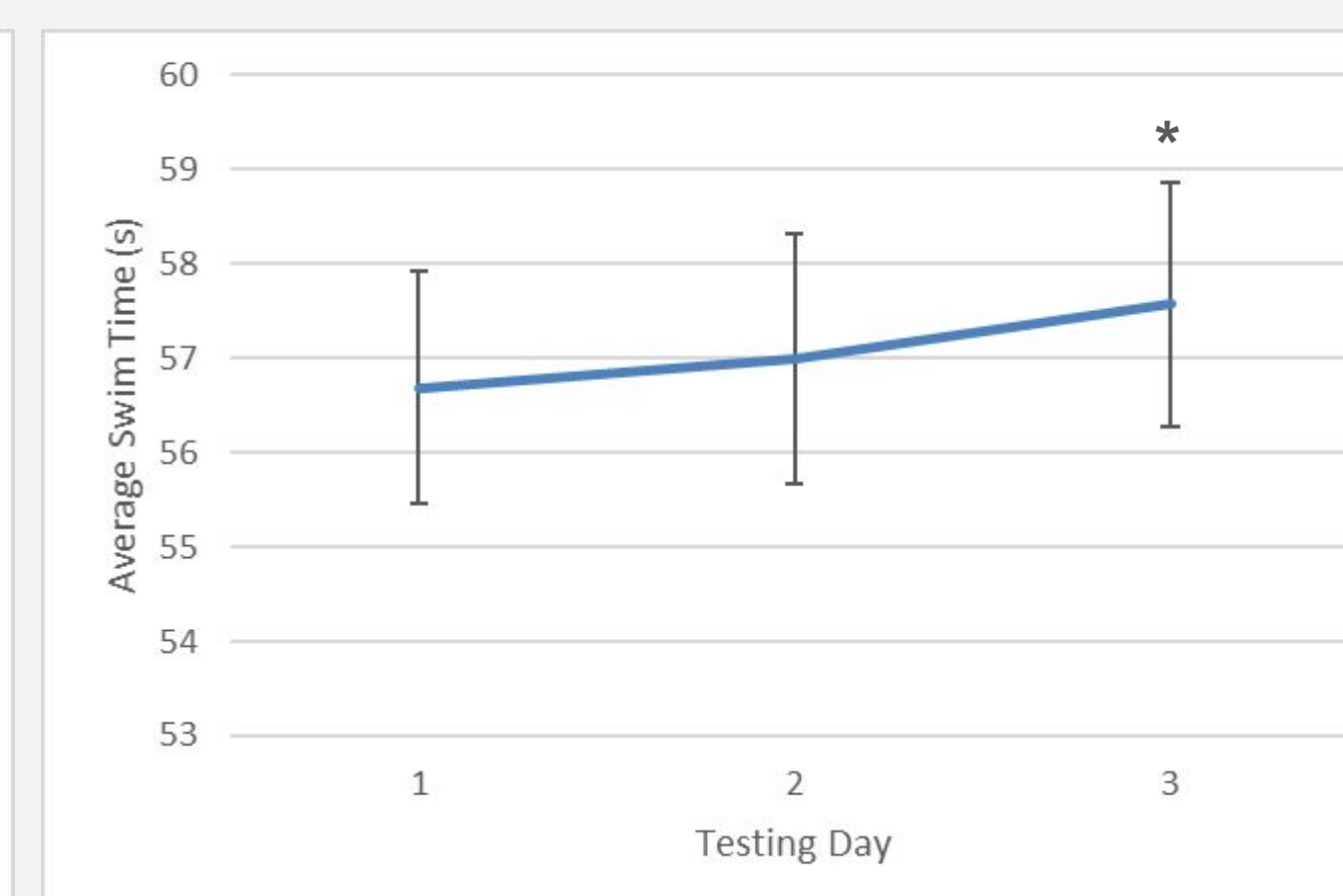


Figure 2. 2nd 100-y Freestyle Swim Times Across Testing Days ($p = 0.038$ between days 1 & 3)

Results cont.

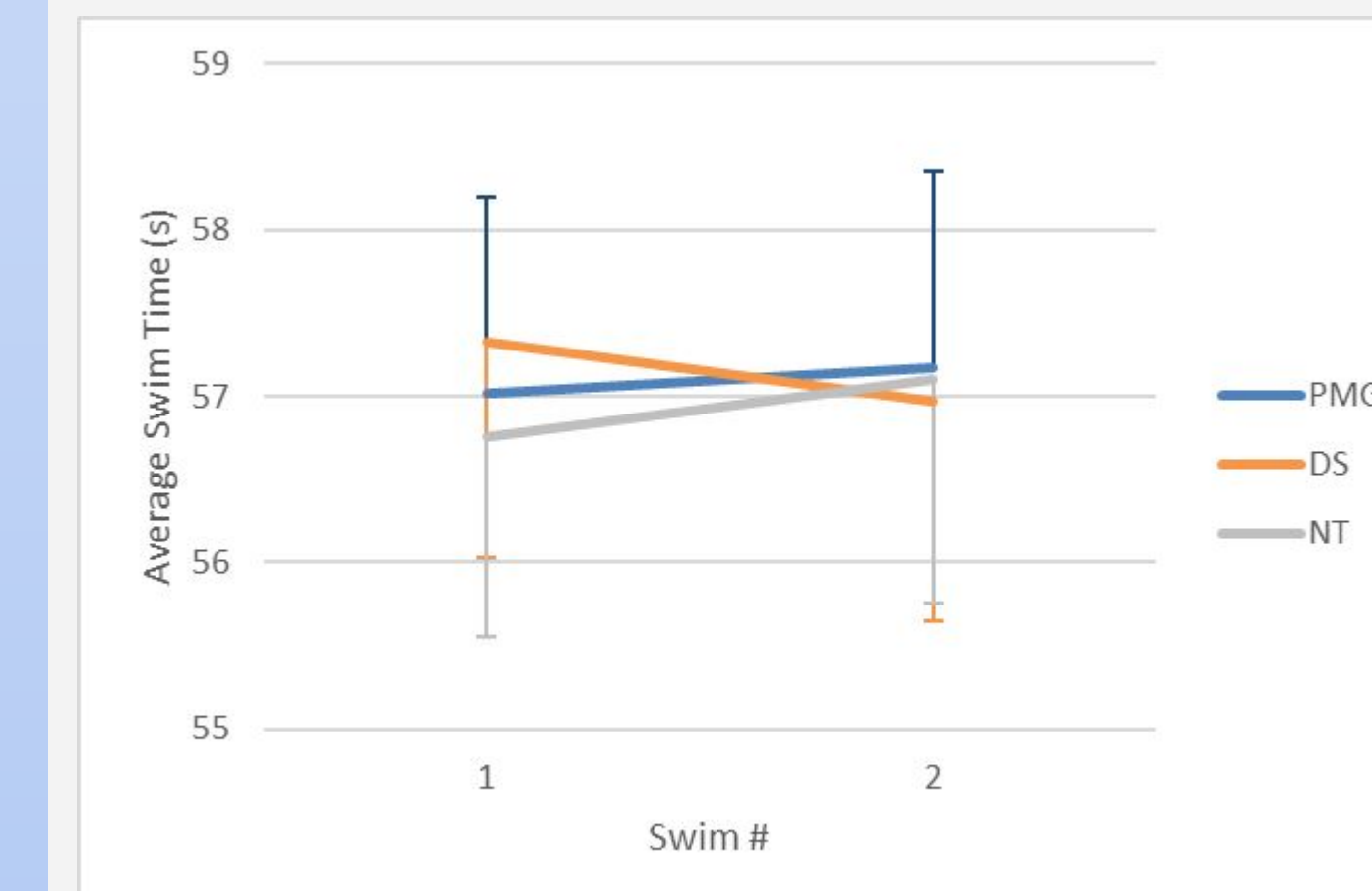


Figure 3. 1st and 2nd 100-y freestyle Swim Times Across Treatments

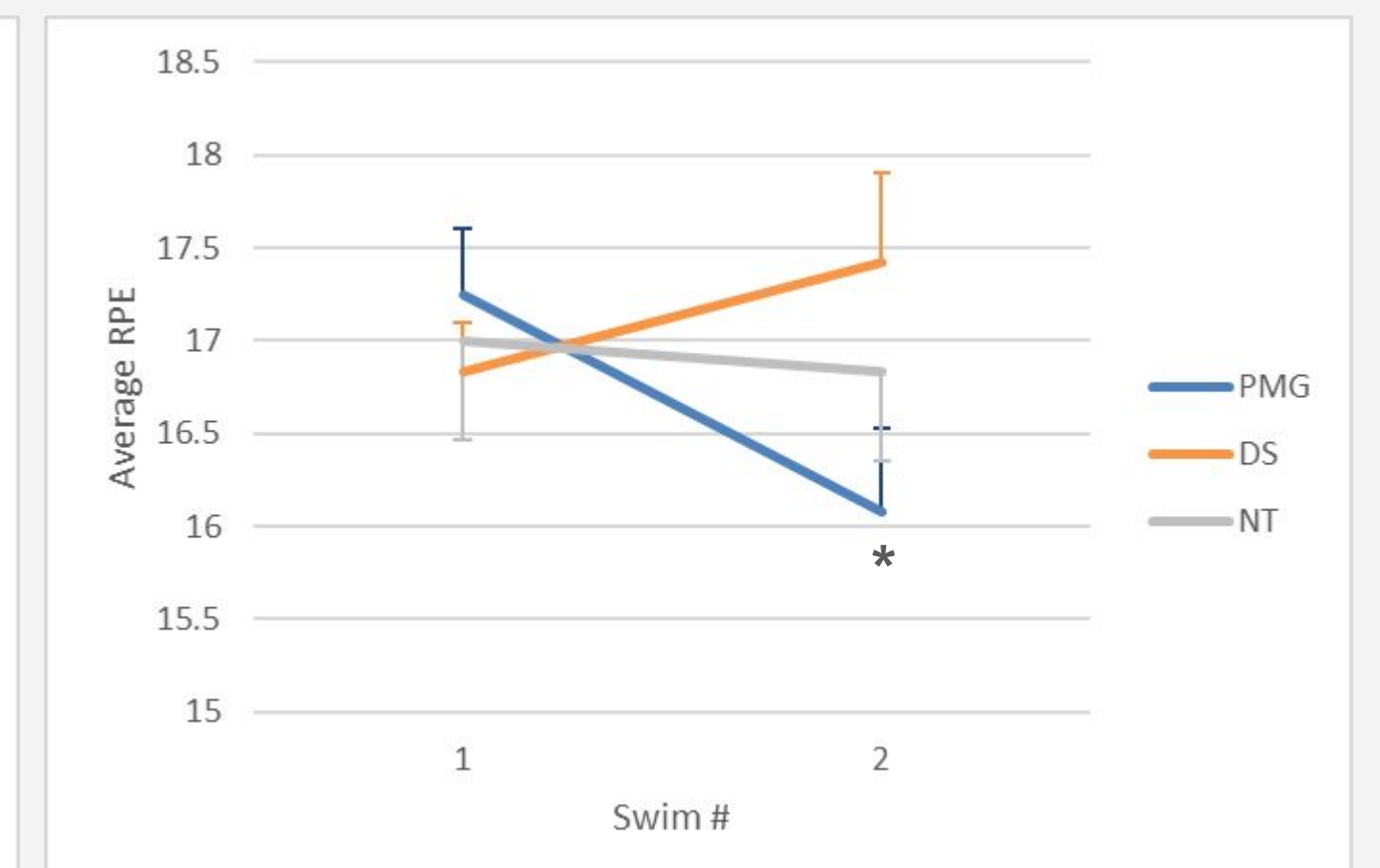


Figure 4. RPE following 1st vs. 2nd 100-y Freestyle Swim by treatment ($p = 0.004$ for PMG)

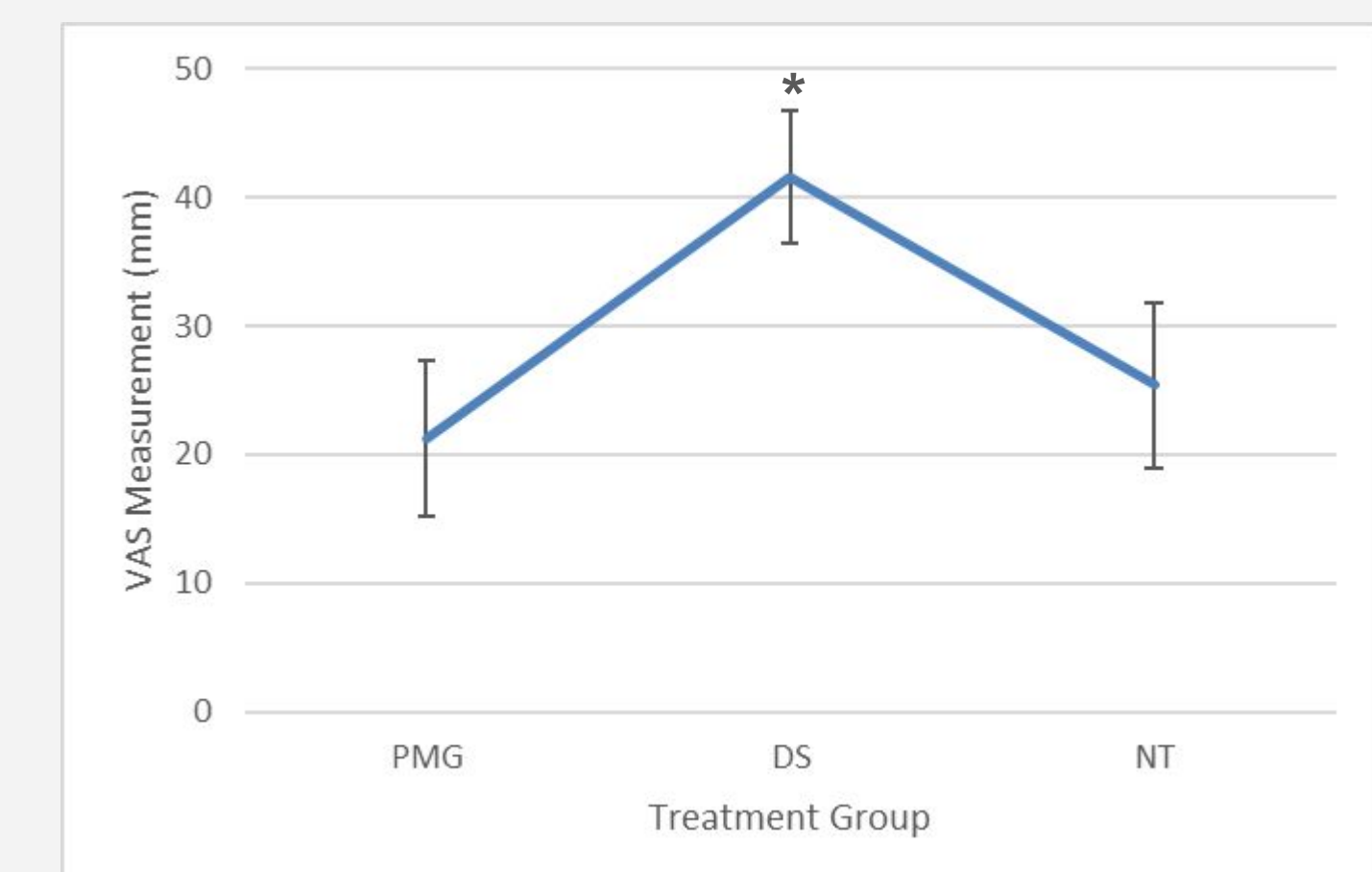


Figure 5. Discomfort Post-Treatment/Pre 2nd 100-y Freestyle Swim ($p = 0.048$ between PMG and DS)

Conclusion

- No significant differences in swim times, regardless of the treatment
- Decrease in completion time between the 1st & 2nd swim in DS group
 - Not a significant difference
- Average 2nd swim time was significantly slower on Day 3 compared to Day 1 regardless of treatment.
- Significant differences were found when comparing level of discomfort
 - Highest levels measured in the dynamic stretching condition
- Average RPE following 2nd swim was significantly lower in PMG

Limitations

- Heart Rate Monitor
 - Irregular data recorded
 - Switching between participants
- Limited time to recruit participants and conduct the study
- Swim meets and consistent diet and sleep
 - Testing sessions 1&2 had a day in between after the meet
 - Testing session 3 was right after a meet
 - Irregular diet and sleep patterns

Participant Comments

- "...made me swim faster, I would use it again." - thoughts on PMG
- "...feeling really tired after the Uchicago meet." - timing of sessions
- "...made my muscles tired before the race." - thoughts about DS

Future Considerations

- Different distances and stroke
 - Longer or shorter
 - Other stroke than freestyle
- Heart rate monitor
 - More for individualized purposes
- Schedule of meets