THE NEUROMODULATIVE ROLE OF THE SPINAL CORD IN COGNITIVE PROCESSING AFTER SUBLIMINAL EXPOSURE TO SEXUAL STIMULI

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BACKGROUND

⌘ Sexual functioning is one of the most important concerns among spinal cord injury (SCI) patients, but it is unfortunately commonly overlooked in the rehabilitation process.[1]

⌘ Injury to the spinal cord affects motor-sensory pathways between brain and body in forward and feedback directions.[2]

⌘ Studies show that cerebral changes do take place after SCI.[2]

⌘ Interestingly, these cerebral changes seem to affect the way SCI patients experience emotions, including sexual themes.[3]

⌘ Sexual responses depend on involuntary (subconscious/ pre-attentive/ automatic) processes, and/or voluntary (conscious/ attentive/ willed) processes.[4]

⌘ To date, no study has evaluated whether SCI patients and normal population cognitively process sexual stimuli differently.

OBJECTIVES

1.) To determine the difference between SCI patients and normal population in the capacity of implicit motor learning associated with choice reaction time task; and

2.) To determine the difference between the two groups in the processing of subliminal prime (Neutral versus Sexual) and explicit target (Neutral versus Sexual) during the performance of choice reaction time task.
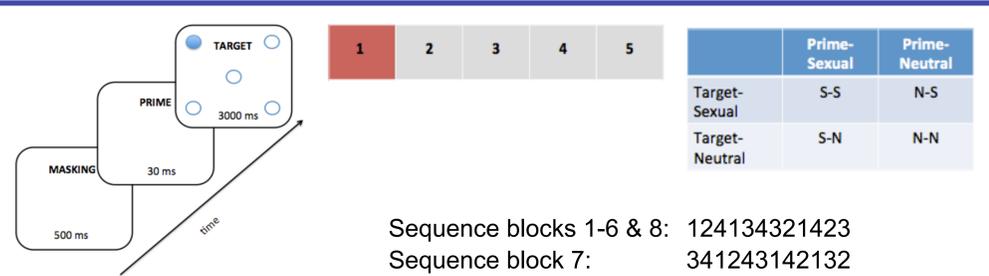
METHODS

Ethical Approval: The protocol was presented to and approved by the hospital ethical board of Ospedale Riabilitativo di Alta Specializzazione, Motta di Livenza in Treviso, Italy.

Participants: 15 SCI patients (10 males, 5 females) and 9 controls (3 males, 6 females).

Materials: 36 "target" pictures and 18 "prime" pictures were used. **Sexual** primes were non-pornographic and rated by a pilot cohort as "highly sexual," while sexual targets were rated as "moderately sexual." In contrast, **neutral** primes and targets were images of landscapes. Everything was alternately presented in a black-and-white, 10x10 cm graphic at the center of a computer monitor using a software (http://www.neurobehavioralsystem.com) that monitored the exact order of image presentation and recorded the responses and choice reaction time.

Procedure: CRT tasks were composed of 8 blocks; each of which consisted of 99 trials. Each trial consisted of a rapid, backward masked, subliminal presentation of one prime (**N**eutral versus **S**exual) followed by one target (**N**eutral versus **S**exual). Thus, the series were divided as: 24 **NN**, 24 **NS**, 24 **SN**, 24 **SS**, & 3 controls. The first 6 blocks contained the repetitions of the sequence 124134321423; the 7th block contained the repetitions of the sequence 341243142132; while the 8th block returned to the sequence of the first 6 blocks. To refrain participants from learning the serial order, the starting position was made different in every block. After a prime was presented, the target picture was shown superimposed with a black dot in one of five possible locations: in one of the four corners or at the center of the image. Participants were then asked to locate the dot as soon as possible by pressing a button on the keyboard corresponding to their choice.

	Prime-Sexual	Prime-Neutral
Target-Sexual	S-S	N-S
Target-Neutral	S-N	N-N

Sequence blocks 1-6 & 8:   124134321423
Sequence block 7:   341243142132

Outcome Measures: Accuracy in the localization of the dot positions, and choice reaction time (CRT).

Statistical Analysis: Using IBM SPSS Statistics Professional 20.0 (alpha=0.05), level of accuracy and CRT were analyzed via ANOVA, with number of block (8), prime (Neutral/ Sexual) and target (Neutral/ Sexual) as within-subject repeated factors, and group and sex as between-subject factors.
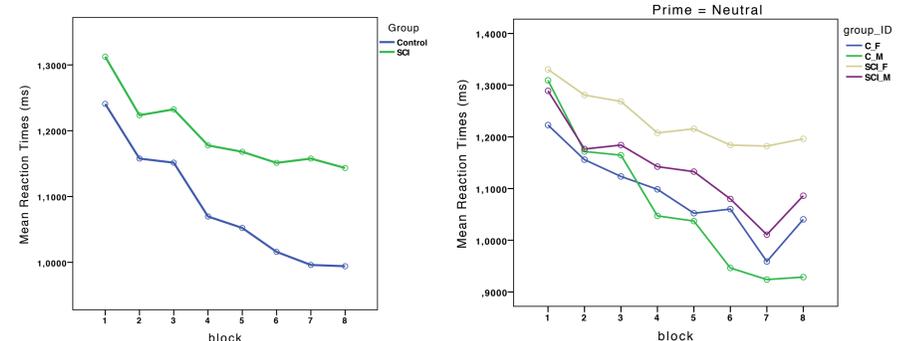
RESULTS/DISCUSSION

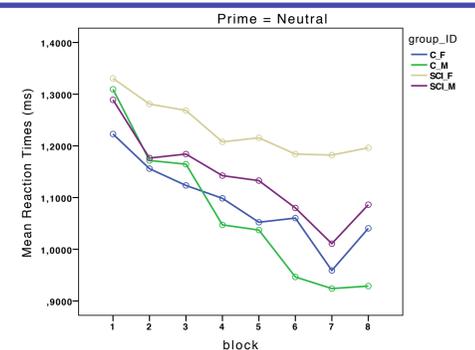Fig. 1: Interaction between block and study group.

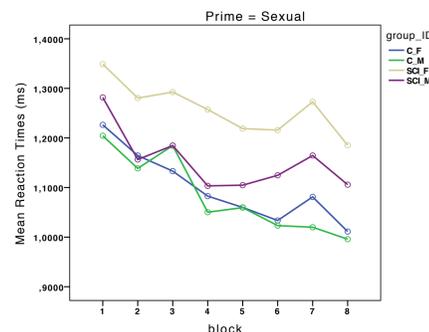Fig. 3: Interaction among block, sex, and study group with neutral prime.

Fig. 2: Interaction among block, sex, and study group with sexual prime.

☑ Number of block had a significant effect (p<0.05) on CRT as well as the interaction between number of block and group (p<0.05; Fig.1). Control group exhibited faster CRT than SCI group across blocks 7 and 8.

☑ A significant effect was found between Target and Sex (p<0.001), with males showing faster CRT for sexual targets (Fig. 2).

☑ A significant interaction was found among Block x Prime x Group x Sex (p<0.05). SCI males and females did not exhibit the decreasing trend in CRT, which was shown by the control group.

☑ SCI females did not show decrease in CRT at block 7, in contrast to SCI males and the control group when prime was neutral (Fig. 3). In contrast for sexual prime, all groups exhibited an increase in CRT at block 7 (SCI males and females were usually slower than controls across each of 8 blocks) (Fig. 2).

☑ Regarding implicit learning tasks, SCI patients did not exhibit the classic 'decline effect' or learning curve along the blocks in contrast to the control group.[4] Sexual content-induced delay seems to suggest that sexual interest for sexual primes significantly modulated the attention among SCI patients, causing significant delay in CRT in contrast to controls.

CONCLUSION

⌘ SCI patients exhibited specific difficulty in implicit motor learning tasks and seemed to perceive and process sexual pictures differently compared with normal population at pre-attentive level, as they continuously showed "content-induced delay" along the blocks.

⌘ These fundamental observations can affect our routine motor, cognitive, psychological, and sexual evaluation and rehabilitation of our SCI patients.

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