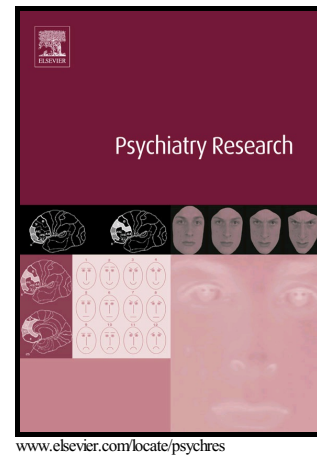


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**The physiological and emotional effects of touch: Assessing a hand-massage intervention
with high self-critics**

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Abstract

Research demonstrates that highly self-critical individuals can respond negatively to the initial introduction of a range of therapeutic interventions. Yet touch as a form of therapeutic intervention in self-critical individuals has received limited prior investigation, despite documentation of its beneficial effects for well-being. Using the Forms of Self-Criticism/Self-Reassuring Scale, 15 high- and 14 low- self-critical individuals (from a sample of 139 females) were recruited to assess how self-criticism impacts upon a single instance of focused touch. All participants took part in a hand massage- and haptic control-intervention. Salivary cortisol and alpha amylase, as well as questionnaire measures of emotional responding were taken before and after the interventions. Following hand massage, analyses revealed cortisol decreased significantly across *all* participants; and that

significant changes in emotional responding reflected well-being improvements across *all* participants. Supplementary analyses further revealed decreased alpha amylase responding to hand massage as compared to a compassion-focused intervention in the same (highly self-critical) individuals. Taken together, the physiological and emotional data indicate high self-critical individuals responded in a comparable manner to low self-critical individuals to a single instance of hand massage. This highlights that focused touch may be beneficial when first engaging highly self-critical individuals with specific interventions.

1. Introduction:

Self-criticism, which is the tendency to harshly judge and scrutinize oneself (Shahar et al., 2012), is a major source of vulnerability to psychopathology. Self-criticism has been implicated in a range of disorders spanning those associated with anxiety, eating, substance abuse and personality (see Kannan and Levitt, 2013 for review). In particular, the vulnerability, course and form of a variety of mental health problems are all linked to self-criticism (Zuroff and Mongrain, 1987; Gilbert et al., 2004; Zuroff et al., 2005; Kannan and Levitt, 2013; Yamaguchi et al., 2014). Self-criticism is also associated with poorer recovery rates from depression (Bulmash et al., 2009) and is a barrier to treatment effectiveness (Rector et al., 2000). Moreover, for women, self-criticism appears to be a characterological trait in both major depression and bipolar disorder, as compared to non-psychiatric controls

(Rosenfarb et al., 1998). Consequently, self-criticism has become a major target for psychotherapeutic interventions, given it has been linked to threat processing and negative thinking, and avoidance of positive emotions (Gilbert and Irons, 2005; Gilbert, 2014). Considering this, stimulating more positive affiliative processes has been recommended as a therapeutic intervention for those higher in self-criticism, with increasing evidence of the effectiveness of this approach (Gilbert and Procter, 2006; Fredrickson et al., 2008; Hutcherson et al., 2008; Laithwaite, et al., 2008; Beaumont et al., 2012; Judge et al., 2012; Braehler et al., 2013).

However, recent research has shown that individuals with higher levels of self-criticism can often be resistant to, or fear, affiliative signals (Gilbert et al., 2011). For example, individuals higher in self-criticism are more likely to have negative reactions to oxytocin - a neuropeptide associated with supportive relationship interactions (Rockliff et al., 2011). In addition, those higher in self-criticism have been found to demonstrate increased amygdala activity indicative of threat processing, when trying to be self-reassuring in response to a shame event (Longe et al., 2010). Finally, following the introduction of a specific form of affiliative exercise - compassion focused imagery (CFI) – individuals higher in self-criticism have been found to: i) report the initial intervention in a negative light (e.g. Duarte et al., 2015; McEwan and Gilbert, 2016); and ii) display elevations in salivary cortisol, salivary alpha amylase and/or decreases in heart rate variability immediately after the intervention (Rockliff et al., 2008; Duarte et al., 2015). Thus, whilst such emotion/affiliative based therapies demonstrate good efficacy in the long-term (Laithwaite et al., 2009; Judge et al., 2012; Braehler et al., 2013), a growing body of research indicates that those higher in

self-criticism and, especially females, may struggle with such interventions initially. Therefore, an alternative method of stimulating affiliative affect systems in those with higher self-criticism could be beneficial when commencing any well-being intervention or therapy. One such method would be to directly stimulate such systems by use of touch/massage.

To expand, the beneficial well-being effects of touch - from brief hugs to handholding, are well documented, with the physiological soothing properties of touch increasingly understood to be linked to oxytocin (Carter, 2013) and vagal regulation of the parasympathetic system (Porges, 2007). Relatedly, massage has also been found to positively impact upon well-being. For example, just five minutes of touch/hand massage reduced salivary cortisol, salivary Chromogranin A and insulin levels (Osaka et al., 2009). Moreover, married couples who used massage as well as 'listening touch' over a four week period experienced increased salivary oxytocin and decreased alpha amylase post intervention compared to control couples (Holt-Lunstad et al., 2008). Such studies indicate that touch and massage have beneficial influences across multiple-stress systems; in particular, decreasing both sympathetic nervous system activity (Drescher et al., 1980; Holt-Lunstad et al., 2008; Lindgren et al., 2010) and hypothalamic-pituitary adrenocortical (HPA) activity (Holt-Lunstad et al., 2008).

Touch and massage have also been used in therapeutic practices (e.g. Field, 1998; Kolcaba et al., 2006; Field et al., 2007; Field et al., 2008). In addition, Gilbert and Procter (2006) reported that patients who simply held a tennis ball during therapy felt more relaxed during such sessions. Similarly, Lucre, a current NHS psychotherapist (2016, personal

communication), reports that in therapy the use of a wide variety of haptic items (pebbles, cubes, beanbags, playful touch etc.) has been important in therapy to enable patients to develop the capacity to self-soothe. Consequently, focused touch may be a suitable means by which to introduce therapeutic practices to highly self-critical individuals. Indeed, given its potential to deactivate physiological and neurological systems associated with threat, touch may offer a means by which to calm and relax clients prior to the introduction of emotion/affiliative based therapies.

The purpose of this study, therefore, was to explore the effects of touch, and specifically hand massage as compared to a haptic control (holding a bean-bag), with individuals (and specifically females) preselected to differ in their levels of self-criticism (i.e. high self-critics vs. low self-critics). To achieve this, we took samples of both salivary alpha amylase (sAA – a marker of sympathetic nervous system activity) and salivary cortisol (a marker of hypothalamic-pituitary axis activity), as well as a number of questionnaire measures of well-being. We hypothesised that the focused touch intervention as compared to the haptic control would lead to: i) a decrease in our physiological measures of negative/threat responding; and ii) positive changes in our emotional indicators of well-being, across *all* individuals (i.e. both high and low self-critics). To explore further the effectiveness of the focused touch intervention, in an additional analysis, participants' physiological response data to the hand massage intervention were compared with a CFI intervention in the same population (Duarte et al., 2015). To briefly recap, in this earlier research, high self-critics were observed to demonstrate physiological (i.e. increased sAA) and emotional responses indicative of a threat/stress response to the CFI intervention.

2. Methods

3.1. Design

We employed a mixed measures crossover design, with 'self-criticism' (HSC vs. LSC) as the between subjects variable and 'touch intervention' (haptic control, hand massage) as the within-subjects variable (see Figure 1). Sample size was calculated based on Rockliff et al. (2008). To obtain an interaction effect for this two by two factorial design with a medium effect size (0.25) and acceptable power (i.e. 0.8; with alpha set at 0.05, one-tailed), the calculated sample size required was 28 (i.e. 14 HSC vs. 14 LSC).

3.2. Participants

We employed a stratified sampling procedure to avoid difficulties associated with post-hoc analysis (and potential floor effects). Participants were screened using the Forms of Self-Criticism/Self-Reassuring scale (FSCSR, Gilbert et al., 2004). Data were collected from 139 female staff and students from a UK University (mean age = 24.96, SD = 6.49 years). Based upon our prospective sample size calculation, 40 extreme scorers (the highest and lowest septiles) on the self-critical component of the FSCSR scoring below 15 (LSC) or above 25 (HSC) were invited to participate in the study. Participants were excluded if they reported a diagnosis of mental health issues. Twenty-nine (15 HSC & 14 LSC) participants completed the study (mean LSC score = 12.29, SD = 5.20; mean HSC score = 34.60, SD = 7.81).

All participants gave informed written consent to participate in the study, which received local Ethics Committee approval.

3.3. Measures

3.3.1 Alpha amylase and cortisol measurement

sAA and cortisol measurement was obtained via saliva samples (Sarstedt Ltd.). For each sample, participants were asked to rinse their mouths with cold water (3 minutes), and then place rolling cotton under their tongue until saturated (about 3 minutes). All samples were then immediately frozen (at -70 Celsius) before being assayed for cortisol and alpha-amylase by Obsidian Research Ltd (Port Talbot, UK) using an Enzyme-Linked ImmunoSorbent.

To minimise the effects of circadian oscillations of both alpha-amylase and cortisol (Rohleder and Nater, 2009), all experimental sessions were conducted between 2 and 7 PM. Additionally, to reduce confounding factors shown to affect physiological dependent measures (Nater et al., 2007), before each experimental session, participants were asked to refrain from a number of behaviours including: excessive physical activity for the preceding 48 hour period; sporting activities for the preceding 24 hours; alcohol intake for the preceding 18 hour period; glucose/caffeine intake and chewing gum on the day of the study; and tooth-brushing, eating or drinking (except water) for the preceding 60 minute period.

2.3.2. Forms of Self-Criticism/Self-Reassuring Scale (FSCRS) (Gilbert et al., 2004)

This 22-item scale assesses participants' thoughts and feelings about themselves during a perceived failure. Two subscales measure forms of self-criticising (*inadequate self* and *hated self*) and one subscale measures tendencies to be reassuring to the self (*reassured self*). Items are rated on a five-point Likert scale. Cronbach's alphas are .90 for inadequate self, .86 for hated self, and .86 for reassured self. To establish self-criticism level a composite score comprising the inadequate self- and hated self- scores was used.

3.3.3. State Adult Attachment Scale (SAAS) (Gillath et al., 2009)

This 21-item scale assesses state attachment. The SAAS differentiates between three psychological processes; *anxiety about attachment*, *avoidance of attachment* and *security-based strategies*. Respondents indicate how much they agree or disagree (right now) with each statement on a 1-7 Likert scale. Cronbach's alphas range from .82 to .91 for *security*, .81 to .85 for *anxiety* and .71 to .87 for *avoidance*.

3.3.4. Types of Positive Affect Scale (Gilbert et al., 2008)

This 12-item scale measures *activated*, *relaxed* and *secure/safe* positive affect. Participants rate how characteristic (right now) each affect word is for them on a 5-point Likert scale. Cronbach's alphas are .83 for the activated and relaxed subscales and .73 for the safe subscale.

3.3.5. Positive Affect and Negative Affect Schedule (PANAS) (Watson et al., 1988)

This 20-item mood scale provides brief measures of positive and negative affect (10 items each respectively). Respondents rate the extent to which they have experienced each

particular emotion within a specific time period (right now), using a 5-point Likert scale. Cronbach's alphas range from .86 to .90 for the *positive affect* scale, and .84 to .87 for the *negative affect* scale.

3.4. General Procedure

The haptic control and hand massage interventions consisted of three phases. In phase 1 (Baseline), participants signed the consent forms then completed the three emotional indicator questionnaires (e.g. the SAAS, TPAS, PANAS). Mid-way through this first phase (approximately 7.5 minutes into phase one), the first sAA and cortisol measurement was taken (i.e. the participants 'baseline' level). In phase 2 participants completed the first intervention (either hand massage or haptic control, counter-balanced across participants). This phase consisted of the task explanation (5 minutes), followed by the specific touch intervention (i.e. hand massage or haptic control; 7 minutes). In phase 3, participants undertook the second counter-balanced touch intervention. This phase consisted of the task explanation (5 minutes) followed by the specific touch intervention (7 minutes). Of note, as the order of touch intervention was counter-balanced across individuals, 50% of participants (i.e. 50% HSC; 50% LSC) completed the hand massage first and 50% of participants completed the haptic control first. In addition, given the difference in timings for sAA and cortisol to reach peak levels, the second and third sAA samples were taken immediately after the different interventions (i.e. control vs. hand massage), whilst the cortisol samples were taken 10 minutes after the interventions.

3.4.1. *Hand Massage (HM) Intervention*

Hand massage (i.e. focused touch) was performed by one of the authors (JD) who had received training in the technique by a specialist in complementary therapy. The hand massage took, on average, 7 minutes, according to the following protocol: first, the participant's hands were held for a few seconds. Second, a non-allergic oil was spread on one of the participant's hands; the masseur used upwards strokes with one hand, whilst supporting the actual participant's hand with their other. The massage started with 'rolling' the participant's wrist, then moving to each finger. After this, the participant's palm was held in a position such that the masseur could apply pressure with their thumb; first on the top of the hand, working gently between each of the metacarpal bones, and then on the palm. Finally, the masseur concluded the massage by holding the participant's hand. The same procedure was then repeated on the other hand.

3.4.2 *Haptic Control (HC) Intervention*

In the HC intervention the participant simply held a bean-bag in their dominant hand for a period of 7 minutes. Thus in this condition the participant was subject to tactile stimulation but in a controlled non-interactive manner. This was similar to the non-interactive tactile method used in therapy by Gilbert and Proctor (2006), but the use of a beanbag increased potential tactile manipulation of the object whilst reducing the likelihood of dropping it. Of note, as with the hand massage condition, the masseur sat opposite the participant to reduce the effects of masseur presence between the two conditions.

In neither condition did the masseur actively engage in dialogue with the participant.

3.4.2. *Supplementary Intervention: Compassion Focused Imagery (CFI)*

In a second testing session seven days apart (but at the same time of day), the same participants took part in a CFI intervention. Whilst this intervention has been reported elsewhere (Duarte et al., 2015), it involved participants generating visual images of a deeply compassionate being (or person) using a standard recording. Importantly, this task was matched in duration to the touch interventions, with the same questionnaire measures utilised and sAA/cortisol samples taken at the same time intervals.

3.5. Data Screening

3.5.1. *Cortisol*

Void results (i.e. analysed swabs containing no cortisol volumes) were returned for one LSC participant. Data from a further HSC participant was identified as an outlier according to their z-scores (i.e. a score of above 4 in the baseline condition). Of the remaining 27 participants, data were analysed for normality of distribution using skewness and kurtosis scores. These analyses revealed cortisol values to be normally distributed across these participants ($N = 27$; comprised of 13 LSC and 14 HSC). However, considering the cross-over design of the study, accordingly all data were log transformed (Miller and Plessow, 2013).

3.5.2 *Alpha Amylase*

Void results were returned for one LSC participant and partial results (i.e. near zero baseline reading) for one HSC participant. Of the remaining 27 participants analyses revealed data to be normally distributed ($N = 27$; comprised of 13 LSC and 14 HSC). Considering the cross-over design of the study, however, and to ensure consistency between physiological measures, data were log transformed.

3.6 Analysis

To accurately analyse the log transformed cortisol and sAA data, we computed delta scores between the post-intervention and baseline phase as recommended by Rohleder and Nater (2009). Mixed measures ANCOVAs were conducted for cortisol data and sAA data with level of self-criticism as the between subjects IV, intervention delta score (HC, HM) as the within-subjects IV and age entered as a covariate. For significant effects, mixed measures ANCOVA were conducted to examine whether condition order (whether participants took part in the HC or HM intervention first) had an effect.

We additionally compared the hand massage intervention delta score data with delta score data from a CFI intervention in the same sample of high and low self-critics (Duarte et al., 2015). We performed this additional analysis to directly compare physiological responses to the two intervention methods. For consistency, all data were log transformed before delta scores were calculated and analyses progressed.

To assess whether level of self-criticism influenced changes in our state measures during the haptic control and hand massage interventions (i.e. on entering the session or

'baseline' vs. immediately post the touch interventions), a mixed measures MANOVA was conducted. Level of self-criticism (low or high) was entered as the between-subjects variable, and PANAS, TPAS & SAAM subscale measures at each time point (baseline, after HC, after HM) as the within-subjects variables.

3. Results

4.1. Physiological Indices of Well-being

Descriptive data for all conditions are presented in Table 1.

4.1.1. Cortisol Data

A mixed measures ANCOVA revealed a significant main effect of condition only ($F(1, 24) = 7.70, p = 0.011, \eta p^2 = 0.24$); age was not a significant covariate. This effect reflected a greater *decrease* in cortisol across all participants following the hand massage- as compared to the haptic control- intervention (Figure 2).

4.1.2 sAA Data

A mixed measures ANCOVA revealed no significant main effects nor any interactions ($p > 0.10$ in all cases).

4.1.3. Control Analyses

A mixed measures ANCOVA revealed no significant main effects of condition order on cortisol ($p > 0.15$).

4.1.4. Additional Analyses: Hand Massage vs. CFI

Descriptive statistics for participants with usable data across both intervention methods are presented in Table 2.

For cortisol, an intervention (CFI, HM) by self-criticism (HSC, LSC) mixed measures ANCOVA revealed no main effects nor interactions ($p > 0.09$ in all cases); although age was a significant covariate ($F(1, 22) = 8.11, p = 0.009, \eta p^2 = 0.27$). However, for alpha amylase a similar intervention (CFI, HM) by sample (HSC, LSC) ANCOVA revealed a significant main effect of intervention ($f(1, 20) = 4.55, p = 0.046, \eta p^2 = 0.19$); age was not a significant covariate ($p > 0.80$). The main effect of intervention reflected a significantly greater *increase* in sAA across all participants following the CFI intervention - as compared to the hand massage intervention (Figure 3). Of note, as we were particularly interested in the effects of these different 'active' interventions upon our high self-critics (leading on from Duarte et al., 2015), in a further analysis we compared sAA responses to massage vs. CFI in our high-self critics only. This revealed a significantly greater increase in sAA when participants took part in the CFI intervention as compared to the hand massage intervention ($t=3.034, df=10, p=0.013$, two-tailed).

4.2 Emotional Indices of Well-being

Results revealed a significant main effect of self-criticism ($F(2,48) = 2.60, p = .04, \eta p^2 = 0.55$) and a significant main effect of condition ($F(2,48) = 7.01, p = .002, \eta p^2 = .92$), but no interaction between self-criticism and condition ($p > .10$). Univariate tests revealed that there were condition effects for TPAS safe, TPAS relax, PANAS negative affect, and SAAM avoidant, in the expected directions. That is, following the hand massage intervention, participants reported increased feelings of safeness and relaxation compared with baseline. In addition, negative affect and avoidance decreased following the hand massage intervention compared with baseline. Following the haptic control, feelings of relaxation also increased, whereas positive affect decreased compared to baseline. The main effect of self-criticism reflected high self-critics reporting feeling less safe, less relaxed, more negative and more avoidant per se.

4. Discussion

This study used both physiological (cortisol and sAA), and emotional indicators of well-being, to explore if focused touch (i.e. hand massage) might be a suitable initial well-being/therapeutic intervention for self-critical individuals. It was hypothesised that hand massage, as compared to a haptic control, would lead to a decrease in our physiological and

emotional indicators of well-being across *all* individuals (i.e. both high and low self-critical females). Consistent with this, results revealed a significant decrease in cortisol across all participants following the hand massage intervention as compared to the haptic control. Results further indicated changes in our emotional indicators in the expected direction; that is, following hand massage, all participants reported increased feelings of safeness and relaxation, and decreased feelings of negative affect and avoidance, as compared to baseline. In comparison, for the haptic control, only feelings of relaxation increased as compared to baseline (consistent with Gilbert and Proctor, 2006), whilst positive affect actually decreased. Finally, when comparing participants' physiological responses to the hand massage intervention with a Compassion Focused Imagery (CFI) intervention in the same sample (Duarte et al., 2015) across all individuals, significant increases in sAA were observed post the CFI intervention as compared to the hand massage intervention. Further analyses revealed these increases likely reflected increases in sAA for the HSC specifically, when engaged in CFI as compared to hand massage. This is indicative of CFI elevating stress hormone levels in such HSC individuals. Results are discussed in turn below.

A growing body of research demonstrates that for those higher in self-criticism, initial therapeutic interventions can prove threatening (Gilbert et al., 2006; Rockliff et al., 2008, Longe et al., 2011; Rockliff et al., 2011; McEwan and Gilbert, 2016). This is despite such therapeutic interventions (e.g. CFI) demonstrating good efficacy with the same individuals in the long-term (Gilbert and Procter, 2006; Laithwaite et al., 2008; Kelly et al., 2010; Beaumont et al., 2012; Judge et al., 2012; Braehler et al., 2013). Thus, that our results demonstrate both HSC and LSC to show comparable decreases in cortisol following hand

massage, as compared to a haptic control (i.e. bean-bag holding), are extremely promising. These results demonstrate that hand massage may be a direct way to stimulate affiliative physiological systems and, therefore, that touch-focused interventions may be of therapeutic value with self-critical individuals.

For adults, the beneficial effects of touch are well documented. To briefly recap, previous research has shown that brief touch/massage can reduce heart rate, salivary cortisol, salivary CgA and/or insulin levels (e.g. Drescher et al., 1980; Osaka et al., 2009; Lindgren et al., 2010). In addition, longer-term touch interventions have been associated with beneficial outcomes across a number of stress-related physiological measures (Holt-Lunstad et al., 2008). As cortisol is a well-established index of HPA-axis activity in response to stress (Holt-Lunstad et al., 2008), our findings suggest that hand-massage resulted in down regulation of the HPA-axis across all participants. Thus, given its potential to deactivate physiological systems associated with threat, we tentatively suggest that focused touch (or hand massage) may have implications for therapy. To expand, as individuals with higher levels of self-criticism can find emotion-based therapies a negative experience in the first instance (e.g. Gilbert et al., 2006; Rockliff et al., 2008; Longe et al., 2011; Rockliff et al., 2011; McEwan and Gilbert, 2016, focused touch may offer an alternative method of stimulating affiliative affect systems in those higher in self-criticism. Our research therefore indicates future detailed (and larger) studies with clinical populations should be directed at the use of focused touch, as a precursor to well-being interventions and/or therapy. This would be especially timely as it would appear that such practices are already being implemented in clinical settings (e.g. Lucre, 2016).

Our emotional indicator data also accord with the physiological data. Following the focused touch intervention (i.e. hand massage), *all* participants reported increased feelings of safeness and relaxation, and decreased feelings of negative affect and avoidance as compared with baseline. This suggests that all participants found the focused touch a positive emotional experience. For the haptic control (beanbag holding), whilst we also observed an increase in feelings of relaxation (as compared to baseline), positive affect actually decreased following this intervention. This may reflect the monotony of this condition, i.e. simply holding a beanbag for a period of time (with no additional task) may not provide sufficient attentional or soothing focus - whereas hand massage (i.e. focused touch) does. Thus, a non-focused touch intervention such as holding a beanbag could consequently lead to mind-wandering and rumination, which is not always positive (Nolen-Hoeksema, 2000; Kinderman et al., 2013).

Of importance, supplementary analyses further revealed participants to respond less favourably to CFI as compared to hand massage. Whilst all participants demonstrated slight increases in sAA for both active interventions, elevation of sAA was especially marked for the HSC after engaging in CFI. As a higher sAA response is indicative of a heightened sympathetic (i.e. threat) response (see Nater and Rohdler, 2009 for review), these physiological results suggest that our HSC sample responded much more negatively to a single-instance of CFI as compared to a single-instance of hand massage. This again highlights that for certain individuals, such as those higher in self-criticism, focused touch may be a suitable initial means by which to introduce well-being and therapeutic practices.

Finally, a further finding of the current study was that intervention order did not mediate physiological responding. This would suggest that results did not reflect general influences of the testing paradigms (e.g. laboratory set-up *per se*).

5.1. Limitations

It is important to note, however, that despite our promising results (and the large effect sizes observed), before clinical efficacy can be argued, our findings need replication in both a larger, and clinical, sample. A second limitation of the present research was our failure to find an effect of hand massage on sAA. Whilst we are not the first authors to report such null findings (Kumar et al., 2013), it may be the case that sAA is more sensitive to ANS dysregulation, especially in those with a tendency toward mental disorders (Schumacher et al., 2013). This would somewhat accord with our CFI findings in high self-critics. That is, sAA may be a more useful indicator of the up-regulation of threat-based systems rather than their deactivation.

5.2. Conclusions

To sum, our physiological and behavioural findings demonstrate that LSC *and* HSC individuals responded favourably to a single-instance of hand massage. As self-criticism is both a major source of vulnerability to psychopathology (especially in females), and a barrier to treatment effectiveness, our findings warrant further study. This includes the

replication of results in a larger (clinical) sample and the investigation of the effects of hand massage on therapeutic outcome. If focused touch interventions offer a means by which to down-regulate threat systems (and promote self-soothing), then such intervention may offer new avenues for therapeutic interventions, especially with those who are highly self-critical.

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Conflicts of Interest:

Professor Gilbert is President of the Compassionate Mind Foundation, the charity whom part funded this research, but took no part in data collection or analysis.

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Figure 1 Caption: Recruitment process and study design flowchart

Figure 2 Caption: Cortisol Delta Score decreases as a function of Touch Intervention (Haptic Control, Hand Massage) and Self-criticism Level, with age covariate estimates. Bars represent one standard error of the mean (SEM).

Figure 3 Caption: Alpha Amylase Delta Scores as a function of Therapeutic Intervention (Hand Massage, CFI) and Self-criticism Level, with age covariate estimates. Bars represent one SEM.

Do let me know if you have any further queries.

Table 1: A. Cortisol and alpha amylase volumes (Mean \pm SD) as a function of condition (baseline, haptic control, hand massage) and self-criticism (Low Self-critics (LSC), high self-critics (HSC)). B. Log transformed & delta score (Mean \pm) data used in analyses.

A.	Cortisol	Alpha Amylase
Baseline		
LSC	6.570 \pm 1.018 (n=13)	30.162 \pm 21.133 (n=13)
HSC	6.357 \pm 1.560 (n=14)	38.793 \pm 28.710 (n=14)
Total	6.459\pm1.307 (n=27)	34.637\pm25.250 (n=27)

Haptic Control

LSC	6.488 ±0.929 (n=13)	37.246±25.832 (n=13)
HSC	5.969±0.817 (n=14)	42.450±24.263 (n=14)
Total	6.219±0.896 (n=27)	39.944±24.682 (n=27)

Hand Massage

LSC	6.126 ±0.884 (n=13)	41.454±36.485 (n=13)
HSC	5.734±0.958 (n=14)	44.507±31.566 (n=14)
Total	5.923±0.927 (n=27)	43.556±33.424 (n=27)

B.**Cortisol****Alpha Amylase****Haptic Control**

LSC	-0.005 ±0.050 (n=13)	0.092 ±0.177 (n=13)
HSC	-0.017 ±0.081 (n=14)	0.067 ±0.161 (n=14)
Total	-0.011 ±0.067 (n=27)	0.079 ±0.161 (n=27)

Hand Massage

LSC	-0.030 ±0.071 (n=13)	0.098 ±0.145 (n=13)
HSC	-0.037 ±0.085 (n=14)	0.063 ±0.170 (n=14)
Total	-0.033 ±0.077 (n=27)	0.080 ±0.156 (n=27)

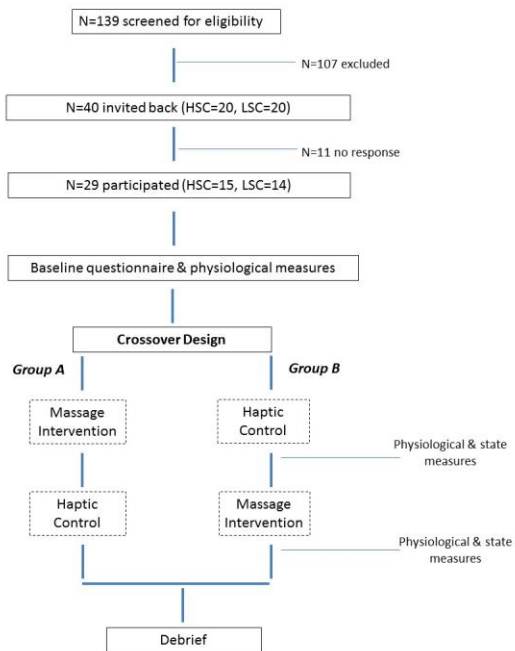
Table 2: Log transformed & delta score (Mean \pm) data as a function of active intervention type and self-criticism.

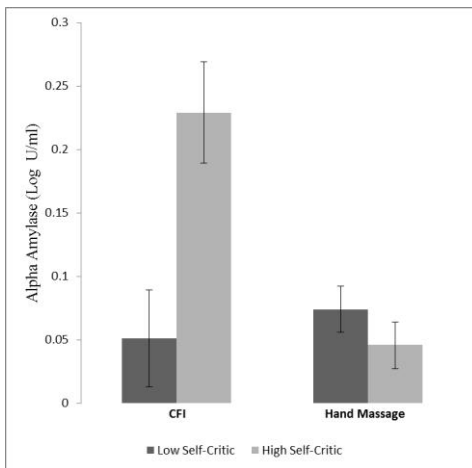
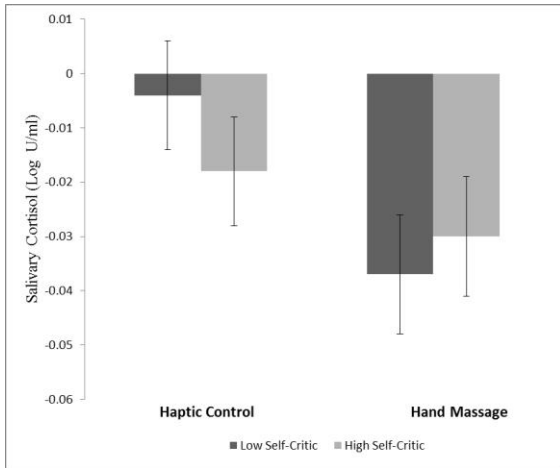
	Cortisol	Alpha Amylase
Hand Massage		
LSC	-0.030 \pm 0.053 (n=13)	0.100 \pm 0.152 (n=12)
HSC	-0.029 \pm 0.074 (n=12)	0.019 \pm 0.101 (n=11)
Total	-0.029 \pm0.071 (n=25)	0.060 \pm0.134 (n=23)
CFI		
LSC	-0.003 \pm 0.053 (n=13)	0.031 \pm 0.152 (n=12)
HSC	0.008 \pm 0.074 (n=12)	0.251 \pm 0.326 (n=11)
Total	0.002 \pm0.063 (n=25)	0.136 \pm0.270 (n=23)

Highlights

- Self-critical individuals can respond negatively to therapeutic interventions
- Touch as an initial therapeutic intervention has received limited investigation
- Hand-massage led to cortisol reductions in both low and high self-critics
- Hand-massage led to positive emotional responding in both low and high self-critics

- Touch/massage may offer new avenues for initial therapeutic interventions





Accepted manuscript