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Personality in speed skaters with skater's cramp: A preliminary cross-sectional study

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ABSTRACT

Objective: Skater's cramp is a debilitating disorder in expert speedskaters and recent evidence from muscle and movement studies nominate it is a task-specific dystonia (TSD). Building on these studies we investigated clinical features and personality in skater's cramp, hypothesizing that similar to other TSDs, trait emotionality would be higher in affected skaters.

Methods: In a cross-sectional study we employed the HEXACO inventory to examine the personality of a cohort of skaters with skater's cramp (n = 26) compared to age, sex, and experience-matched controls (n = 28). Affected skaters were selected based on relevant clinical features important to the diagnosis of TSD.

Results: Sentimentality (a sub-factor of emotionality) was higher in affected skaters, but only in the male population. Extraversion was lower in skaters with skater's cramp. Clinical findings resembled other forms of TSD.

Discussion: Higher sentimentality is in line with previous studies in TSD. Lower Extraversion in affected skaters was an unexpected finding that may be a new feature of skater's cramp and TSD. Due to our small sample size and cross-sectional design, these findings are preliminary, but offer tentative evidence of personality differences in skater's cramp in line with TSD.

1. Introduction

Dystonia is a movement disorder generally described by 'sustained or intermittent muscle contractions causing abnormal, often repetitive, movements and postures' [1]. A subsection of this disorder is task-specific, ergo task-specific dystonia (TSD), and has been defined as "a collection of movement disorders that present with persistent muscular incoordination or loss of motor control during skilled movements" [2]. TSD is known to affect a host of occupational skills including hairdressers, tailors, watchmakers or weavers [3–5]. It is also common in musicians and athletes with 1% of professional musicians affected [6], and higher estimates for golfers, reporting a tentative 20% [7,8]. Clinically, TSD has a sudden onset after many years of unaffected practice and progresses insidiously over a course of weeks or months [9]. The exact pathophysiology of TSD is unknown, but research indicates it may arise as a result of corruption in the formation of highly specific motor engrams. Skilled practice is thought to produce longer motor engrams

for longer sequences of movement [10], which replace intermediate motor-control representations and reduce motor adaptability. In turn, this may increase susceptibility to forming task-specific errors resulting in jerking, over-activation and co-activation [11]. Triggers for forming these errors include over-practicing, stress, injury, equipment change and genetics [6,11].

Skater's cramp is a mysterious movement disorder in professional and highly dedicated amateur speed skaters. It was first nationally recognized as a movement disorder when a high profile Olympic speed skater from the Netherlands prematurely ended his career as a consequence of developing this disorder. Skater's cramp was first described as an *endo-* or *exo-* rotation of a speed skater's foot, occurring right before placing their skate on the ice after a completed stroke [12]. Subsequently it was hypothesized to be TSD [13], and quantitative studies have supported this hypothesis finding features of movement, muscle activity and inter-muscular coherence that support this diagnosis. [14–16].

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In addition to muscle and movement features, non-motor differences have also been described in TSD. In dystonia generally, higher anxiety has been found in adult-onset isolated focal dystonia [17] and functional dystonia [18]. In TSD specifically, sensitivity to negative emotion in the form of higher baseline anxiety has been described in musician's dystonia [19]. Another study using the well validated NEO Five-Factor Inventory (NEO-FFI) [20] showed the trait neuroticism (sensitivity to negative affect) was higher in affected musicians [21]. Two later studies found no significance using the NEO-FFI, but did identify differences in other anxiety related factors not only in musicians [22], but also in other TSDs in sports like golf [23] and baseball [24].

Building on evidence that skater's cramp is a TSD [14–16], and tentative evidence that personality is different in known TSDs [21], the purpose of this study was to test whether personality was also different in skater's cramp. Specifically, we hypothesized that skaters with skater's cramp would exhibit higher neuroticism (i.e., negative emotionality) in line with previous studies [23]. We further explored differences in other personality traits (honesty, extraversion, agreeableness, conscientiousness, openness) without directional predictions. To improve accuracy despite the limitations of a small sample size (due to the rarity of skater's cramp) we controlled for natural population variance by matching affected skaters with a control group for age and sex, as well as experience and dedication to speedskating.

2. Methods

2.1. Population

Participants with skaters cramp filled out an online survey that was accessed through a link. We recruited participants by email and telephone request directed at various Dutch speed skating clubs across the country. The coaches of 7 speed skating clubs (two in Heerenveen, and one in Harlem, Amsterdam, Leiden, Enschede, and The Hague respectively) were contacted, and they were requested to suggest to their skaters to fill out the survey. There was no separate recruiting process for control participants, who were recruited at the same time from the same speed skating clubs by coaches who suggested they fill out the survey. All participants were admitted to the control group by answering "no" to the question: *Do you think you have, or think you have had skater's cramp?* Additionally we invited the impacted group and control group from a previous case control study of skaters with skater's cramp ($n = 14$) to participate via email [16]. In the previous study these participants had undergone a physical examination by a neurologist (MT). Both previously recruited and newly recruited participants were selected for the affected group by answering "yes" to the question: *Do you think you have, or think you have had skater's cramp?* and additionally answering "yes" to two further inclusion criteria (self-report) questions: *"Have you ever been unable to control one of your skates during skate placement?"*, and *"Do you notice cramping or jerking of your skate during skate placement?"*. Control participants were recruited from the same skating clubs as the newly recruited participants to increase the likelihood they would be matched for various confounds including sex, age, hours of practice per week (prior to developing the condition), and years of skating. To insure they were matched we compared these factors statistically (see analysis section). All participants were over the age of 18, volunteered for this study and gave their informed consent. Data was collected between April 20 and July 7th 2022. Participants were informed they could retract their data and participation in the study at any time. The Medical Ethical committee of the University Medical Center Groningen approved the study (M119.241754).

2.2. Measurement tools

All participants newly recruited and from the previous study filled out a bespoke survey.

The bespoke survey was based on an edited version of a survey

employed in an initial case study of skaters with skater's cramp [14]. We collected demographic and clinical details of skaters important to the diagnosis of movement disorders like TSD. Questions included detailed information on 1) skating career: experience level, years spent skating, and dedication 2) medical history: pre-existing conditions relating to injury, or mental/physical pathology including possible symptoms of depression 3) skater's cramp: rate of onset, task-specificity, pain level, and possible contributing factors. The survey collected additional basic information i.e. age, sex.

To investigate the personality profile of skaters we employed the validated HEXACO personality inventory [25] consisting of 6 personality factors: Honesty-Humility (avoid manipulating others), Emotionality (high sensitivity to emotions and stress), eXtraversion (high social confidence and self-esteem), Agreeableness (high forgiveness of others), Conscientiousness (high perfectionism and organization), Openness to Experience (high imaginativeness and curiosity for the unusual). For each factor there are 4 facets that are highly internally correlated to the major factors [25]. HEXACO is an extension of the original well established lexical strategy for the investigation of personality called the five factor model or "big five" [20]. The big five consists of Neuroticism (N) (also referred to as neuroticism), Extraversion (X), Agreeableness (A), Conscientiousness (C), and Openness to Experience (O) (NXACO). HEXACO has been shown to accurately model these same 5 factors consistently (emotionality has replaced neuroticism, but represents the same factor) [26,27], while adding an additional factor Honesty-Humility (H). The extent to which Honesty-Humility is factorially distinctive from the remaining 5 is still under investigation [28], however many studies support a 6 factor model [27].

The HEXACO model is further broken down into 24 facets (4 facets per factor). Honesty-Humility is comprised of: sincerity (an honest and genuine approach in a social context), fairness (the tendency to avoid fraud), greed avoidance (being uninterested in wealth), modesty (to have an unassuming and humble disposition). Emotionality: fearfulness (experiencing relative high levels aversion to harm), anxiety (a tendency to worry and feel high nervousness in different contexts), dependence (reliance on peers for reassurance and support), sentimentality (an inclination to strong emotional attachment). Extraversion: social self-esteem (a positive self-perceptions in social interactions), social boldness (being bold and self-assured in social contexts), sociability (being enthusiastic to engage with others), liveliness (demonstrating high enthusiasm and optimism). Agreeableness: forgiveness (a tendency to forgive in the face of harm), gentleness (demonstrating lenience and compassion with others), flexibility (being adaptable and willing to compromise), patience (the tendency to calmly wait without frustration). Conscientiousness: organization (seeking order and structure), diligence (working hard through tasks), perfectionism (thoroughness and attention to detail), prudence (the inclination to caution, and vigilant foresight). Openness to Experience: aesthetic appreciation (enjoyment of beauty and art), inquisitiveness (having high curiosity and eagerness to explore), creativity (having an affinity for innovation and experimentation), and unconventionality (a tendency to accept the unusual).

The HEXACO model measured responses on a 5 point Likert scale evaluation, where participants responded to relevant statements related to the factors and facets choosing either, strongly disagree, disagree, neutral, agree, or strongly agree. To investigate these personality differences in the Netherlands, we employed a validated Dutch translation of the HEXACO [29], consisting of 96 questions, 16 questions for each of the six HEXACO factors (4 questions per facet).

2.3. Analysis

An a priori power analysis was conducted using G*Power (psychology.ihhu.de/) [30] that revealed 56 participants would suffice in a factorial between group ANOVA with two fixed factors, group (affected vs controls) and sex (male vs female) to detect a small to medium size effect

(partial η^2 of 0.12) assuming a power equaling 0.8 and an alpha of 0.05. Our conservative estimate of possible effect sizes was assumed appropriate, based on findings from previous similar studies [23,31]. In light of the rarity of this condition in the general population, a larger sample size is not feasible.

All analyses were performed using SPSS statistics version 28.0.1 (IBM.com). Multiple tests were used to confirm that the affected skaters and control skaters were correctly matched. Chi-squared test and Mann-Whitney test were applied to measure whether the experimental and control group were matched for sex and age respectively. We used Mann-Whitney test as well to confirm that the affected and control groups were matched for hours of practice and years of skating.

Analysis of variance (ANOVA) was applied to compare the affected group and control group for the 6 major factors and 20 facets of HEXACO. The dependent variable was the personality factor or facet (e.g. Extraversion), and the two independent fixed factors were TSD (affected skaters vs control skaters), and sex (male vs female). Authors took care to define the fixed factor sex in accordance with guidelines for Sex and Gender Equity in Research [32]. The reason to include sex as an independent factor is acknowledging the natural sex difference in personality – specifically emotionality [33]. In cases of an interaction effect between factors: TSD and sex, we conducted further post-hoc pairwise comparisons, comparing the affected skaters to the control skaters for males and female groups separately employing Bonferroni correction for multiple testing. For both factor and facet ANOVA analyses, assumptions of homogeneity variance were tested with Levene’s test, and assumptions of multivariate normality were tested with the Shapiro-Wilk test, skewness and kurtosis and QQ plots.

3. Results

3.1. Study samples

Of the an initial 81 speed skating respondents, 65 completed the survey. 16 participants did not complete the survey, providing incomplete responses to the clinical survey section and completing none of the HEXACO questionnaire. Of the 14 participants invited from the experimental and control group from a previous study of skater’s cramp, 5 participants responded and 5 were included. Of the remaining newly recruited respondents 11 were excluded who answered positively to having skater’s cramp, but negatively to one or both of the additional inclusion criteria questions. Twenty-six participants answered yes to both questions and comprised the affected group (Male $n = 17$, Mage [mean age] = 53.7, SD = 9.5; Female $n = 9$, Mage = 44.1, SD = 9.6). Twenty-eight participants answered “no” to having skater’s cramp and comprised the control group (Male $n = 19$, Mage = 48.8, SD = 13.8; Female $n = 9$, Mage = 41.5, SD = 13.9). The affected and control groups did not differ in the ratio of men to women, their age, their hours of practice per week (prior to developing the condition), and years of skating. The results and statistical tests used to match groups are

Table 1
Sample population skater’s cramp ($n = 26$) control ($n = 28$).

	Skater’s Cramp	Control	p-Value	Effect Size
Age median (IQR)	51.0 (13.8)	50.5 (19.8)	0.63 [†]	.01 ^a
Sex n (%)				
Female	9	9	0.85 [‡]	.03 ^b
Male	17	19		
Years of skating mean \pm SD	31.6 \pm 14.9	30.4 \pm 14.7	0.76 [♦]	.082 ^c
Practice hours a week mean \pm SD	5.6 \pm 4.1*	5.7 \pm 4.3	0.96 [♦]	-.015 ^c

N = number of participants, p = probability value, IQR = interquartile range, SD = standard deviation, [†]Mann-Whitney, ^aRank-Biserial Correlation, [‡]Chi-Squared Test, ^bCramer’s V, [♦]Independent t-test, ^cCohen’s d, *Practice hours prior to developing skater’s cramp.

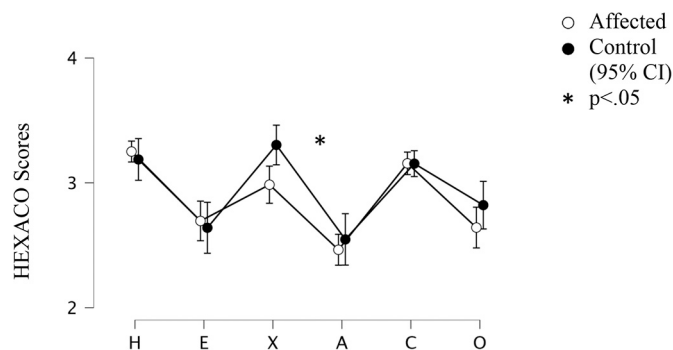


Fig. 1. HEXACO: Skater’s cramp vs control.

depicted in Table 1.

3.2. Skater’s cramp clinical characteristics

Skater’s cramp was painless and task-specific with a sudden onset. In the survey all skaters reported no pre-existing injuries or medical conditions associated with the disorder. In participants selected from the previous study of skater’s cramp ($n = 14$) who underwent a examination by a neurologist (MT), there were no abnormalities reported. Self-reported rates of a history of depression were within normal bounds (12%) and did not differ from the control group (11%). Most affected skaters had received some form of medical diagnosis (81%), but none had received a successful treatment of any kind and the rate of recovery was zero. Self-reported triggering factors varied, where a fall/injury or over-exertion were most commonly reported. In Appendix A, a table depicts key clinical characteristics of the group with skater’s cramp.

3.3. HEXACO: Major factors and facets

3.3.1. Sentimentality

The main effect of TSD on the facet Sentimentality (a facet of the factor Emotionality) was non-significant, $F(1,50) = 0.2, p = .65$, partial $\eta^2 = 0.004$, however there was a significant TDS \times Sex interaction effect, $F(1,50) = 6.68, p = .01$, partial $\eta^2 = 0.12$. Post-hoc analysis revealed that affected male skaters (Mean \pm SD: 3.09 \pm 0.56) had higher sentimentality then control male skaters (Mean \pm SD: 2.58 \pm 0.79), $F(1,50) = 5.34, p = .024$, partial $\eta^2 = 0.1$ (Fig. 2). Affected female skaters (Mean \pm SD: 2.94 \pm 0.72) did not appear to show a significant difference with control female skaters (Mean \pm SD: 3.42 \pm 0.41), $F(1,50) = 2.32, p = .13$, partial $\eta^2 = 0.04$. Though, due to the low sample size ($n = 9$) of females in the affected group, we could not draw any meaningful conclusion from the post-hoc pairwise analysis comparing affected female skaters vs control female skaters.

Table 2

ANOVA: Factors/facets of HEXACO with independent factors: Affected vs control and males vs females.

Factor/Facet	Sex	Group Affected Mean ± SD	Group Control Mean ± SD	ANOVA F(1,50)									Pairwise comparisons	
				Group Affected/Control			Sex Male/Female			Interaction: Group*Sex			p	SE
				p	F	η ²	p	F	η ²	p	F	η ²		
Honst./Humil. (Factor)	Total:	3.25 ± 0.32	3.18 ± 0.42	0.59	0.3	0.01	0.54	0.38	0.00	0.98	0.00	0.00		
Emotionality (Factor)	Total:	2.69 ± 0.43	2.64 ± 0.5	0.65	0.2	0.00	0.01	7.57	0.13	0.02	6.23	0.11		
	Male:	2.68 ± 0.4	2.43 ± 0.42										0.08	0.14
	Female:	2.72 ± 0.53	3.07 ± 0.34										0.08	0.2
Extraversion (Factor)	**Total:	2.99 ± 0.39	3.3 ± 0.4	0.009	7.4	0.13	0.12	2.53	0.05	0.85	0.04	0.00		
Agreeableness (Factor)	Total:	2.46 ± 0.32	2.54 ± 0.52	0.63	0.23	0.1	0.02	5.8	0.1	0.67	0.18	0.00		
Conscien. (Factor)	Total:	3.16 ± 0.33	3.15 ± 0.23	0.91	0.01	0.00	0.43	0.61	0.01	0.76	0.1	0.00		
Open. to Exp. (Factor)	Total:	2.99 ± 0.39	3.3 ± 0.4	0.28	1.2	0.02	0.87	0.03	0.00	0.67	0.18	0.00		
Sociability (Facet Ext.)	Total:	2.69 ± 0.41	3.12 ± 0.6	0.005	8.75	0.15	0.4	0.72	0.01	0.6	0.28	0.01		
Sentimentality (Facet Emot.)	Total:	3.04 ± 0.61	2.85 ± 0.79	0.92	0.01	>0.01	0.07	3.34	0.06	0.01	6.68	0.12		
	*Male:	3.09 ± 0.56	2.58 ± 0.79										0.02	0.22
	Female:	2.94 ± 0.72	3.42 ± 0.41										0.13	0.31

SD = Standard Deviation, Honst./Humil. = Honesty and Humility, Conscien. = Conscientiousness, Open. to Exp = Openness to Experience, Ext. = Extraversion, Emot. = Emotionality, p = probability, ** = p > .01, * = p > .05, F = F value, η²: partial eta squared, SE = standard error.

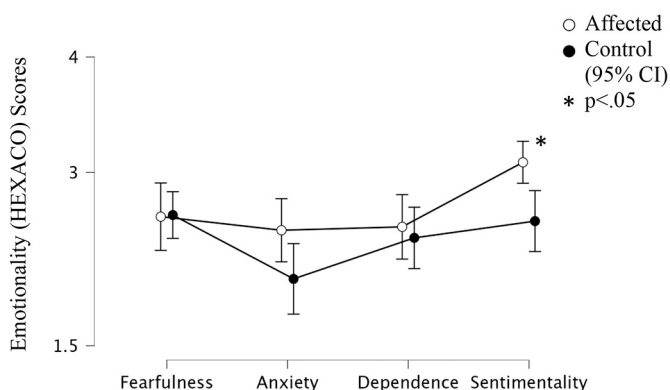


Fig. 2. Facets: Emotionality (only male).

3.3.2. Extraversion

Extraversion was lower in affected skaters (Mean ± SD: 2.99 ± 0.39) compared to controls (Mean ± SD: 3.3 ± 0.4), F(1,50) = 7.4, p = .009, partial η² = 0.13 (Fig. 1). Within the individual facets of the factor Extraversion, scores for the facet Sociability were lower in the affected skating group (Mean ± SD: 2.69 ± 0.41) compared to controls (Mean ± SD: 3.12 ± 0.6), F(1,50) = 8.75, p = .005, partial η² = 0.15. Consult Table 2 for all significant results. For the complete output consult Appendix B.

3.3.3. Other factors

There were no differences in the factors honesty and humility, agreeableness, conscientiousness, or openness to experience between the affected group and the control group. For further details on descriptive statistics and parametric tests for these factors please consult Table 2.

3.4. Assumptions

Assumptions of homogeneity of variance were equal for the 6 major factors and 20 facets of HEXACO (Levene’s test: p < .05). Major factors and facets of HEXACO were normally distributed (Shapiro-Wilk test: p > .05). Skewness and kurtosis values were not deviant for any of these facets (±2 and ±7 respectively) [34,35] and QQ plots appeared normal.

4. Discussion

Our study aimed to compare the personality of skater’s affected with

skater’s cramp to age-, sex- and skating experience-matched controls. We found affected skaters were higher in sentimentality (a facet of emotionality) only in the male population. Furthermore, the whole group of TSD was lower in extraversion. Clinical features of skaters with skater’s cramp were comparable with TSD with a similar age of onset, rate of onset, rate of recovery [36], level of task-specificity, absence of pain, and ratio of men to women [9,37,38]. Higher sentimentality in males and lower extraversion in general may relate to a new feature of personality that is distinctive to skater’s cramp and possibly also a feature of TSD (a field of study in its infancy).

4.1. High sentimentality

Higher sentimentality in males of our study (comprising the majority of the experimental group) resembled similar results in TSD in musicians and athletes [21,24]. The results of the male skater’s cramp group are comparable with the broader literature around emotionality and other forms of TSD [21]. It is not exactly known why emotionality appears higher in TSD, but a shared neurological mechanism for developing anxiety and movement disorders has been proposed [39]. Studies show that decreased inhibition in cortical and sub-cortical networks underlying TSD [40,41], are also involved in anxiety sensitivity [42]. Specifically, motor loops involving the basal ganglia and frontal cortex are thought to negatively influence limbic loops relying on similar brain regions [18,21]. It is possible that our tentative result of higher sentimentality, albeit only in the male sub-population, is an indicator of a common dysregulation between motor and limbic loops, as posited in other forms of TSD [39]. Although highly preliminary, higher sentimentality may indicate another link between TSD and skater’s cramp, and supports future research on personality in TSD.

Importantly, our findings were limited to a male sub-population. Due to too few participating females (n = 9), we draw no firm conclusions for that group separately, and only propose the male group (n = 17) may be higher in sentimentality based on the interaction and pairwise results. Previous studies of TSD and personality have had the same limitation, with too few female participants for subgroup analysis in the study, 4/24, (16%) [22], 4/20 (20%) [19], 15/64 (27%) [23], and 0/19 (0%) [24]. Therefore, it is still an open question whether sex is a determinant of differences in emotionality both in skater’s cramp and in TSD generally. Despite these limitations, we deemed it justified to report our sex-specific findings, arguing that the known higher emotionality in healthy females [33] and the known higher prevalence of TSD in males at 4:1 [38] suggests a possible interaction effect that justifies looking at female and male groups separately.

4.2. Low extraversion

The entire group of affected skaters scored significantly lower on the major factor extraversion, specifically lower on the facet Sociability. This finding is not supported by the literature as no examples of lower extraversion have been found in TSDs. One explanation unrelated to skater's cramp is that we inadvertently selected for a more social control group. Meanwhile affected participants may have been more motivated by a need to understand their disorder, resulting in a disparity in social engagement scores.

Alternatively, lower extraversion may indeed relate to skater's cramp, and not to our selection procedure. Supporting this notion, extraversion scores for the control group were not higher than an average Dutch population [43] (skaters: Mean \pm SD: 3.3 ± 0.4 compared to average Dutch: Mean \pm SD: 3.32 ± 0.45). If extraversion was indeed lower in affected skaters, it may relate to higher emotionality in TSD through a common dopaminergic mechanism. Anxiety sensitivity has been shown to correlate not only with higher emotionality, but also with lower extraversion [44]. This is partly because both tendencies downregulate dopamine [45]. Importantly, insufficient dopamine in striatal pathways is also involved in the development of TSD [46]. Therefore, maladaptive downregulation of dopamine between basal ganglia and frontal cortex may be the shared mechanism that causes higher emotionality, lower extraversion, and a higher risk of TSD. Experiments with larger experimental groups conducted on different forms of TSD are needed to investigate the possible multidimensional relationship between emotionality/extraversion, dopamine and TSD.

4.3. Limitations

This study had limitations: primarily it remains challenging to clearly capture differences in personality with a 6 (HEXACO) or 5 (NEO-PI) factor model when constricted by the small sample sizes available when studying TSD. For example of the 5 studies employing NEO-PI who found higher anxiety in those with TSD, only three found a direct difference in NEO-PI [21,24,47], the other two required more complex statistics and other psychometric tests to find similar results [22,23]. The study did not employ tests to control for psychological characteristics comorbid with TSD and personality, such as depression and higher anxiety. Finally, the use of a cross-sectional design limited our ability to observe longitudinal changes and possible causal relationships. Despite these limitations, we employed methods to improve the validity of our findings. In conducting this study, we adhered the same thresholds for population size and statistical power that have previously been used in other studies of personality and TSD [21,23,24]. Furthermore, we employed a very strict matching of affected and healthy participants to control for covariant factors that influence personality like age [48], sex [33], and dedication to sports [49].

5. Conclusion

In other TSDs in sports and music, higher emotionality has been found. We further supported the link between a TSD and sentimentality showing that sentimentality (a facet of emotionality) was higher in skaters cramp but only in males. Additionally, we found that Extraversion was lower in the whole group of affected skaters. This may be a new feature of personality in skater's cramp specifically, or in TSD more generally. Due to a small sample size and the underrepresentation of female participants in our group and in TSD and personality research in general, our results are a tentative further step in examining personality difference in skater's cramp and TSD.

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To indicate compliance with the preceding declaration and that I have obtained agreement from all of the authors of this paper to declare their compliance as well, I place an x here: X.

Author Statement

I as representative of myself and all authors affirm that the submission of this manuscript is in compliance with the following ethical requirements:

1. This study was conducted in accordance with the Declaration of Helsinki, and all persons provided informed consent prior to being included in the study.
2. The study was reviewed by the Medical Ethical Committee of the university medical hospital of Groningen (UMCG) ruled IRB approval was not necessary for this study (M119.241754)
3. The authors declare that participants provided signed consent that findings of this study could be used in scientific research and the presentation of scientific research.
4. The authors declare that the manuscript is original, it is not being considered for publication elsewhere and will not be submitted elsewhere while under consideration for the Journal of Psychiatric Research or after it has been accepted by the Journal of Psychiatric Research. Authors declare there was also no ghost writing by anyone not named in the author list.
5. The authors have seen and approved the manuscript in the form it is being submitted to the journal. The authors declare that they have conformed to the highest standards of ethical conduct in the submission of accurate data and that they acknowledge the work of others when applicable.
6. Authors roles (CRediT): **B. Nijenhuis:** Conceptualization, Methodology, Formal analysis, Writing - Original Draft **T. van Zutphen:** Conceptualization, Writing - Review & Editing, Project administration **P.Gul:** Methodology, Formal analysis, Writing - Review & Editing, **E. Otten:** Conceptualization, Methodology, Writing - Review & Editing, **M.A.J. Tijssen:** Conceptualization, Methodology Writing - Review & Editing, Supervision.
7. To indicate compliance with the preceding declaration and that I have obtained agreement from all of the authors of this paper to declare their compliance as well, I place an x here: X.

Declaration of Competing Interest

None.

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Appendix A. Population characteristics skater's cramp (n = 26)

Onset time (weeks)	1.5 ± 31.1
Median ± SD	
Task specificity of skater's cramp n(%)	
Symptoms at rest	1 (4%)
While running	4 (15%)
Only while skating	22(85%)
Self-reported trigger factors n (%)	
Injury/Fall	7(27%)
Equipment change	2(8%)
Technique change	3(12%)
Over-training	5(19%)
Nothing reported	9 (35%)
Pre-existing injury/medical condition n (%)	4 (15%) (none movement related)
Reported history of depression n (%)	3 (12%)
Recovery n (%)	0 (0%)
Pain n (%)	0 (0%)
Unilateral (one leg) n (%)	24 (92%)
Joint pain n (%)	4 (15%) (unrelated to affected limb)
Quit due to symptoms n (%)	17 (65%)
Received a diagnoses n (%)	21 (81%)(not TSD)
Attempted treatment	9 (35%)
Successful treatment	0 (0%)

N = number of participants, p = probability value, SD = standard deviation.

Appendix B. Descriptive statistics for all factors/facets of HEXACO for experimental and control group, and divided along factors of Subjects: Affected/control and Sex: Males/Female

	Subjects	Sex	Mean	Std. Deviation	N	
Emotionality		0	2.72	0.53	9	
	Affected	1	2.68	0.40	17	
		Total	2.69	0.44	26	
		0	3.08	0.34	9	
	Control	1	2.43	0.42	19	
		Total	2.64	0.50	28	
		0	2.90	0.47	18	
	Total	1	2.55	0.43	36	
		Total	2.67	0.47	54	
		0	2.83	0.43	9	
Fearfulness	Affected	1	2.62	0.35	17	
		Total	2.69	0.39	26	
		0	2.78	0.34	9	
	Control	1	2.63	0.37	19	
		Total	2.68	0.36	28	
		0	2.81	0.38	18	
	Total	1	2.63	0.36	36	
		Total	2.69	0.37	54	
		0	2.61	0.76	9	
		Affected	1	2.50	0.72	17
Anxiety		Total	2.54	0.72	26	
		0	3.03	0.64	9	
	Control	1	2.08	0.63	19	
		Total	2.38	0.77	28	
		0	2.82	0.72	18	
	Total	1	2.28	0.70	36	
		Total	2.46	0.74	54	
		0	2.47	0.86	9	
		Affected	1	2.53	0.67	17
		Total	2.51	0.72	26	
Dependence		0	3.08	0.52	9	
	Control	1	2.43	0.67	19	
		Total	2.64	0.69	28	
		0	2.78	0.76	18	
	Total	1	2.48	0.66	36	
		Total	2.58	0.70	54	
		0	2.94	0.72	9	
		Affected	1	3.09	0.56	17
		Total	3.04	0.61	26	
		0	3.42	0.41	9	
Sentimentality	Control	1	2.58	0.79	19	
		Total	2.85	0.79	28	
		0	3.18	0.62	18	
	Total	1	2.82	0.73	36	

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	Subjects	Sex	Mean	Std. Deviation	N
		Total	2.94	0.71	54
		0	3.29	0.46	9
	Affected	1	3.23	0.24	17
		Total	3.25	0.32	26
		0	3.24	0.21	9
HonestyHumility	Control	1	3.16	0.50	19
		Total	3.19	0.43	28
		0	3.27	0.35	18
	Total	1	3.19	0.39	36
		Total	3.22	0.38	54
		0	2.86	0.64	9
	Affected	1	3.03	0.46	17
		Total	2.97	0.52	26
		0	2.81	0.41	9
Sincerity	Control	1	2.80	0.62	19
		Total	2.80	0.55	28
		0	2.83	0.52	18
	Total	1	2.91	0.55	36
		Total	2.88	0.54	54
		0	3.70	0.52	9
	Affected	1	3.47	0.44	17
		Total	3.55	0.47	26
		0	3.44	0.56	9
Fairness	Control	1	3.53	0.55	19
		Total	3.50	0.54	28
		0	3.57	0.54	18
	Total	1	3.50	0.49	36
		Total	3.52	0.50	54
		0	3.17	0.88	9
	Affected	1	2.97	0.48	17
		Total	3.04	0.64	26
		0	3.22	0.36	9
GreedAvoidance	Control	1	2.86	0.86	19
		Total	2.97	0.75	28
		0	3.19	0.65	18
	Total	1	2.91	0.70	36
		Total	3.00	0.69	54
		0	3.44	0.61	9
	Affected	1	3.45	0.33	17
		Total	3.45	0.44	26
		0	3.47	0.52	9
Modesty	Control	1	3.47	0.56	19
		Total	3.47	0.54	28
		0	3.46	0.55	18
	Total	1	3.46	0.46	36
		Total	3.46	0.49	54
		0	2.88	0.42	9
	Affected	1	3.04	0.37	17
		Total	2.99	0.39	26
		0	3.17	0.55	9
Extraversion	Control	1	3.37	0.30	19
		Total	3.30	0.40	28
		0	3.02	0.50	18
	Total	1	3.21	0.37	36
		Total	3.15	0.42	54
		0	3.19	0.63	9
	Affected	1	3.49	0.40	17
		Total	3.38	0.50	26
		0	3.42	0.38	9
SocialSelfEsteem	Control	1	3.72	0.38	19
		Total	3.63	0.40	28
		0	3.31	0.52	18
	Total	1	3.61	0.40	36
		Total	3.51	0.46	54
		0	2.58	0.68	9
	Affected	1	2.72	0.65	17
		Total	2.67	0.65	26
		0	2.78	0.81	9
SocialBoldness	Control	1	3.08	0.58	19
		Total	2.98	0.66	28
		0	2.68	0.74	18
	Total	1	2.91	0.63	36
		Total	2.83	0.67	54
		0	2.56	0.41	9
Sociability	Affected	1	2.76	0.41	17
		Total	2.69	0.41	26

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	Subjects	Sex	Mean	Std. Deviation	N	
Liveliness	Control	0	3.08	0.82	9	
		1	3.13	0.49	19	
		Total	3.12	0.60	28	
	Total	0	2.82	0.68	18	
		1	2.96	0.48	36	
		Total	2.91	0.56	54	
	Affected	0	3.19	0.89	9	
		1	3.20	0.49	17	
		Total	3.20	0.64	26	
	Agreeableness	Control	0	3.39	0.50	9
			1	3.54	0.48	19
			Total	3.49	0.48	28
Total		0	3.29	0.71	18	
		1	3.38	0.51	36	
		Total	3.35	0.58	54	
Affected		0	2.31	0.38	9	
		1	2.55	0.26	17	
		Total	2.46	0.32	26	
Forgiveness		Control	0	2.31	0.50	9
			1	2.66	0.51	19
			Total	2.55	0.52	28
	Total	0	2.31	0.43	18	
		1	2.61	0.41	36	
		Total	2.51	0.44	54	
	Affected	0	1.83	0.52	9	
		1	2.25	0.54	17	
		Total	2.11	0.56	26	
	Gentleness	Control	0	2.19	0.70	9
			1	2.41	0.74	19
			Total	2.34	0.72	28
Total		0	2.01	0.63	18	
		1	2.33	0.65	36	
		Total	2.23	0.65	54	
Affected		0	2.69	0.58	9	
		1	2.84	0.51	17	
		Total	2.79	0.53	26	
Flexibility		Control	0	2.67	0.47	9
			1	2.96	0.66	19
			Total	2.87	0.61	28
	Total	0	2.68	0.51	18	
		1	2.90	0.59	36	
		Total	2.83	0.57	54	
	Affected	0	2.00	0.54	9	
		1	2.43	0.43	17	
		Total	2.28	0.51	26	
	Patience	Control	0	1.86	0.63	9
			1	2.22	0.68	19
			Total	2.11	0.68	28
Total		0	1.93	0.57	18	
		1	2.32	0.58	36	
		Total	2.19	0.60	54	
Affected		0	2.69	0.98	9	
		1	2.68	0.56	17	
		Total	2.68	0.71	26	
Conscientiousness		Control	0	2.53	0.72	9
			1	3.04	0.63	19
			Total	2.88	0.69	28
	Total	0	2.61	0.84	18	
		1	2.87	0.62	36	
		Total	2.78	0.70	54	
	Affected	0	3.22	0.38	9	
		1	3.13	0.30	17	
		Total	3.16	0.33	26	
	Organization	Control	0	3.18	0.22	9
			1	3.14	0.24	19
			Total	3.15	0.23	28
Total		0	3.20	0.30	18	
		1	3.13	0.27	36	
		Total	3.16	0.28	54	
Affected		0	2.94	0.45	9	
		1	2.93	0.45	17	
		Total	2.93	0.44	26	
Total		0	2.89	0.60	9	
		1	2.99	0.44	19	
		Total	2.96	0.49	28	
Total	0	2.92	0.51	18		

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	Subjects	Sex	Mean	Std. Deviation	N	
Diligence		1	2.96	0.44	36	
		Total	2.94	0.46	54	
		0	3.72	0.48	9	
	Affected	1	3.47	0.51	17	
		Total	3.56	0.51	26	
		0	3.67	0.57	9	
	Control	1	3.68	0.34	19	
		Total	3.68	0.42	28	
		0	3.69	0.51	18	
	Total	1	3.58	0.44	36	
		Total	3.62	0.46	54	
		0	3.31	0.70	9	
Perfectionism	Affected	1	3.10	0.76	17	
		Total	3.17	0.73	26	
		0	3.36	0.73	9	
	Control	1	2.97	0.68	19	
		Total	3.10	0.71	28	
		0	3.33	0.70	18	
	Total	1	3.03	0.71	36	
		Total	3.13	0.71	54	
		0	2.89	0.40	9	
	Prudence	Affected	1	3.00	0.34	17
			Total	2.96	0.36	26
			0	2.81	0.33	9
Control		1	2.92	0.34	19	
		Total	2.88	0.34	28	
		0	2.85	0.35	18	
Total		1	2.96	0.34	36	
		Total	2.92	0.35	54	
		0	2.67	0.27	9	
OpennesstoExperience		Affected	1	2.63	0.42	17
			Total	2.64	0.37	26
			0	2.76	0.48	9
	Control	1	2.85	0.64	19	
		Total	2.82	0.59	28	
		0	2.72	0.38	18	
	Total	1	2.74	0.55	36	
		Total	2.73	0.50	54	
		0	2.53	0.48	9	
	AestheticAppreciation	Affected	1	2.54	0.65	17
			Total	2.54	0.59	26
			0	2.78	0.76	9
Control		1	2.92	0.93	19	
		Total	2.88	0.87	28	
		0	2.65	0.63	18	
Total		1	2.74	0.82	36	
		Total	2.71	0.76	54	
		0	2.92	0.33	9	
Inquisitiveness		Affected	1	3.13	0.42	17
			Total	3.06	0.40	26
			0	2.94	0.51	9
	Control	1	3.17	0.54	19	
		Total	3.10	0.53	28	
		0	2.93	0.42	18	
	Total	1	3.15	0.48	36	
		Total	3.08	0.47	54	
		0	2.61	0.77	9	
	Creativity	Affected	1	2.44	0.74	17
			Total	2.50	0.74	26
			0	2.81	0.72	9
Control		1	2.82	1.00	19	
		Total	2.81	0.91	28	
		0	2.71	0.73	18	
Total		1	2.64	0.90	36	
		Total	2.66	0.84	54	
		0	2.61	0.69	9	
Unconventionality		Affected	1	2.40	0.60	17
			Total	2.47	0.63	26
			0	2.53	0.67	9
	Control	1	2.49	0.64	19	
		Total	2.50	0.64	28	
		0	2.57	0.66	18	
	Total	1	2.44	0.62	36	
		Total	2.49	0.63	54	
		0	2.49	0.63	54	

B.1. Full results of ANOVA and pairwise comparisons

Here are the full set of result for the ANOVA comparing affected group and control group for the 6 major factors and 20 facets of HEXACO. The **dependent variable** was personality factor or facet (e.g. Extraversion), and **fixed factors** was TSD (affected skaters vs control skaters), and sex (male vs female). The first table labeled “Test of Between-Subjects Effects” describes between subjects effects, and the second table describes post-hoc pairwise comparisons using Bonferroni correction. Significant results are reported in **bold**.

Tests of between-subjects effects								
	Dependent variable	Sum of squares	df	Mean square	F	Sig.	Partial eta squared	
Subjects	Emotionality	0.04	1.00	0.04	0.20	0.65	0.00	
	Fearfulness	0.01	1.00	0.01	0.04	0.85	0.00	
	Anxiety	0.00	1.00	0.00	0.00	0.99	0.00	
	Dependence	0.80	1.00	0.80	1.71	0.20	0.03	
	Sentimentality	0.00	1.00	0.00	0.01	0.92	0.00	
	HonestyHumility	0.04	1.00	0.04	0.30	0.59	0.01	
	Sincerity	0.24	1.00	0.24	0.81	0.37	0.02	
	Fairness	0.12	1.00	0.12	0.47	0.49	0.01	
	GreedAvoidance	0.01	1.00	0.01	0.02	0.88	0.00	
	Modesty	0.01	1.00	0.01	0.04	0.85	0.00	
	Extraversion	1.13	1.00	1.13	7.36	0.01	0.13	
	SocialSelfEsteem	0.64	1.00	0.64	3.34	0.07	0.06	
	SocialBoldness	0.92	1.00	0.92	2.09	0.16	0.04	
	Sociability	2.40	1.00	2.40	8.75	0.01	0.15	
	Liveliness	0.87	1.00	0.87	2.64	0.11	0.05	
	Agreeableness	0.04	1.00	0.04	0.23	0.63	0.01	
	Forgiveness	0.81	1.00	0.81	1.96	0.17	0.04	
	Gentleness	0.03	1.00	0.03	0.08	0.78	0.00	
	Flexibility	0.35	1.00	0.35	1.04	0.31	0.02	
	Patience	0.12	1.00	0.12	0.24	0.63	0.01	
	Conscientiousness	0.00	1.00	0.00	0.01	0.91	0.00	
	Organization	0.00	1.00	0.00	0.00	0.99	0.00	
	Diligence	0.08	1.00	0.08	0.35	0.56	0.01	
	Perfectionism	0.02	1.00	0.02	0.03	0.86	0.00	
	Prudence	0.08	1.00	0.08	0.65	0.43	0.01	
	OpennesstoExperience	0.30	1.00	0.30	1.20	0.28	0.02	
	AestheticAppreciation	1.18	1.00	1.18	2.05	0.16	0.04	
	Inquisitiveness	0.01	1.00	0.01	0.06	0.81	0.00	
	Creativity	0.97	1.00	0.97	1.36	0.25	0.03	
	Unconventionality	0.00	1.00	0.00	0.00	0.99	0.00	
	Sex	Emotionality	1.36	1.00	1.36	7.57	0.01	0.13
		Fearfulness	0.39	1.00	0.39	2.86	0.10	0.05
		Anxiety	3.37	1.00	3.37	7.18	0.01	0.13
Dependence		1.05	1.00	1.05	2.26	0.14	0.04	
Sentimentality		1.44	1.00	1.44	3.34	0.07	0.06	
HonestyHumility		0.06	1.00	0.06	0.38	0.54	0.01	
Sincerity		0.08	1.00	0.08	0.28	0.60	0.01	
Fairness		0.07	1.00	0.07	0.26	0.61	0.01	
GreedAvoidance		0.95	1.00	0.95	1.97	0.17	0.04	
Modesty		0.00	1.00	0.00	0.00	0.99	0.00	
Extraversion		0.39	1.00	0.39	2.53	0.12	0.05	
SocialSelfEsteem		1.07	1.00	1.07	5.63	0.02	0.10	
SocialBoldness		0.58	1.00	0.58	1.31	0.26	0.03	
Sociability		0.20	1.00	0.20	0.73	0.40	0.01	
Liveliness		0.07	1.00	0.07	0.21	0.65	0.00	
Agreeableness		1.04	1.00	1.04	5.80	0.02	0.10	
Forgiveness		1.19	1.00	1.19	2.89	0.10	0.06	
Gentleness		0.57	1.00	0.57	1.74	0.19	0.03	
Flexibility		1.87	1.00	1.87	5.54	0.02	0.10	
Patience		0.73	1.00	0.73	1.52	0.22	0.03	
Conscientiousness		0.05	1.00	0.05	0.62	0.44	0.01	
Organization		0.02	1.00	0.02	0.09	0.77	0.00	
Diligence		0.16	1.00	0.16	0.76	0.39	0.02	
Perfectionism		1.04	1.00	1.04	2.03	0.16	0.04	
Prudence		0.15	1.00	0.15	1.26	0.27	0.03	
OpennesstoExperience		0.01	1.00	0.01	0.03	0.87	0.00	
AestheticAppreciation		0.08	1.00	0.08	0.13	0.72	0.00	
Inquisitiveness		0.59	1.00	0.59	2.67	0.11	0.05	
Creativity		0.08	1.00	0.08	0.11	0.75	0.00	
Unconventionality		0.20	1.00	0.20	0.48	0.49	0.01	
Subjects*Sex		Emotionality	1.12	1.00	1.12	6.23	0.02	0.11
		Fearfulness	0.01	1.00	0.01	0.11	0.75	0.00
		Anxiety	2.10	1.00	2.10	4.48	0.04	0.08
	Dependence	1.50	1.00	1.50	3.21	0.08	0.06	
	Sentimentality	2.89	1.00	2.89	6.68	0.01	0.12	

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Tests of between-subjects effects							
	Dependent variable	Sum of squares	df	Mean square	F	Sig.	Partial eta squared
	HonestyHumility	0.00	1.00	0.00	0.00	0.98	0.00
	Sincerity	0.09	1.00	0.09	0.30	0.59	0.01
	Fairness	0.30	1.00	0.30	1.14	0.29	0.02
	GreedAvoidance	0.09	1.00	0.09	0.18	0.67	0.00
	Modesty	0.00	1.00	0.00	0.00	1.00	0.00
	Extraversion	0.01	1.00	0.01	0.04	0.85	0.00
	SocialSelfEsteem	0.00	1.00	0.00	0.00	0.95	0.00
	SocialBoldness	0.08	1.00	0.08	0.18	0.67	0.00
	Sociability	0.08	1.00	0.08	0.28	0.60	0.01
	Liveliness	0.07	1.00	0.07	0.20	0.65	0.00
	Agreeableness	0.03	1.00	0.03	0.18	0.67	0.00
	Forgiveness	0.12	1.00	0.12	0.30	0.59	0.01
	Gentleness	0.07	1.00	0.07	0.21	0.65	0.00
	Flexibility	0.01	1.00	0.01	0.04	0.85	0.00
	Patience	0.84	1.00	0.84	1.75	0.19	0.03
	Conscientiousness	0.01	1.00	0.01	0.10	0.76	0.00
	Organization	0.04	1.00	0.04	0.18	0.67	0.00
	Diligence	0.22	1.00	0.22	1.01	0.32	0.02
	Perfectionism	0.10	1.00	0.10	0.20	0.66	0.00
	Prudence	0.00	1.00	0.00	0.00	0.98	0.00
	OpennesstoExperience	0.05	1.00	0.05	0.18	0.67	0.00
	AestheticAppreciation	0.05	1.00	0.05	0.08	0.77	0.00
	Inquisitiveness	0.00	1.00	0.00	0.00	0.97	0.00
	Creativity	0.10	1.00	0.10	0.14	0.71	0.00
	Unconventionality	0.09	1.00	0.09	0.22	0.64	0.00
Error	Emotionality	9.00	50.00	0.18			
	Fearfulness	6.87	50.00	0.14			
	Anxiety	23.45	50.00	0.47			
	Dependence	23.27	50.00	0.47			
	Sentimentality	21.60	50.00	0.43			
	HonestyHumility	7.45	50.00	0.15			
	Sincerity	14.79	50.00	0.30			
	Fairness	13.10	50.00	0.26			
	GreedAvoidance	24.08	50.00	0.48			
	Modesty	12.68	50.00	0.25			
	Extraversion	7.65	50.00	0.15			
	SocialSelfEsteem	9.52	50.00	0.19			
	SocialBoldness	21.92	50.00	0.44			
	Sociability	13.70	50.00	0.27			
	Liveliness	16.39	50.00	0.33			
	Agreeableness	8.92	50.00	0.18			
	Forgiveness	20.62	50.00	0.41			
	Gentleness	16.50	50.00	0.33			
	Flexibility	16.85	50.00	0.34			
	Patience	24.03	50.00	0.48			
	Conscientiousness	4.04	50.00	0.08			
	Organization	11.27	50.00	0.23			
	Diligence	10.77	50.00	0.22			
	Perfectionism	25.73	50.00	0.52			
	Prudence	6.12	50.00	0.12			
	OpennesstoExperience	12.58	50.00	0.25			
	AestheticAppreciation	28.77	50.00	0.58			
	Inquisitiveness	10.99	50.00	0.22			
	Creativity	35.66	50.00	0.71			
	Unconventionality	20.51	50.00	0.41			
Total	Emotionality	395.49	54.00				
	Fearfulness	396.63	54.00				
	Anxiety	355.69	54.00				
	Dependence	385.19	54.00				
	Sentimentality	493.19	54.00				
	HonestyHumility	566.76	54.00				
	Sincerity	464.56	54.00				
	Fairness	684.36	54.00				
	GreedAvoidance	512.69	54.00				
	Modesty	659.11	54.00				
	Extraversion	545.33	54.00				
	SocialSelfEsteem	676.38	54.00				
	SocialBoldness	457.38	54.00				
	Sociability	474.31	54.00				
	Liveliness	623.28	54.00				
	Agreeableness	349.46	54.00				
	Forgiveness	290.44	54.00				
	Gentleness	449.31	54.00				
	Flexibility	278.06	54.00				

(continued on next page)

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Tests of between-subjects effects								
Dependent variable		Sum of squares	df	Mean square	F	Sig.	Partial eta squared	
Patience		444.19	54.00					
Conscientiousness		541.65	54.00					
Organization		479.50	54.00					
Diligence		719.13	54.00					
Perfectionism		557.44	54.00					
Prudence		467.19	54.00					
OpennesstoExperience		416.99	54.00					
AestheticAppreciation		427.88	54.00					
Inquisitiveness		523.44	54.00					
Creativity		419.81	54.00					
Unconventionality		354.56	54.00					
Pairwise comparisons								
Dependent variable	Sex	Subjects	Subjects	Mean difference	Std. error	Sig. ^b	95% confidence interval for difference	
							Lower bound	Upper bound
Emotionality	0	Affected	Control	-0.36	0.20	0.08	-0.76	0.04
	1	Affected	Control	0.25	0.14	0.08	-0.03	0.54
Fearfulness	0	Affected	Control	0.06	0.18	0.75	-0.30	0.41
	1	Affected	Control	-0.01	0.12	0.91	-0.26	0.24
Anxiety	0	Affected	Control	-0.42	0.32	0.20	-1.07	0.23
	1	Affected	Control	0.42	0.23	0.07	-0.04	0.88
Dependence	0	Affected	Control	-0.61	0.32	0.06	-1.26	0.04
	1	Affected	Control	0.10	0.23	0.68	-0.36	0.55
Sentimentality	0	Affected	Control	-0.47	0.31	0.13	-1.10	0.15
	1	Affected	Control	0.51	0.22	0.02	0.07	0.95
HonestyHumility	0	Affected	Control	0.06	0.18	0.75	-0.31	0.42
	1	Affected	Control	0.06	0.13	0.63	-0.20	0.32
Sincerity	0	Affected	Control	0.06	0.26	0.83	-0.46	0.57
	1	Affected	Control	0.23	0.18	0.22	-0.14	0.59
Fairness	0	Affected	Control	0.26	0.24	0.29	-0.23	0.74
	1	Affected	Control	-0.06	0.17	0.75	-0.40	0.29
GreedAvoidance	0	Affected	Control	-0.06	0.33	0.87	-0.71	0.60
	1	Affected	Control	0.12	0.23	0.62	-0.35	0.58
Modesty	0	Affected	Control	-0.03	0.24	0.91	-0.51	0.45
	1	Affected	Control	-0.03	0.17	0.87	-0.37	0.31
Extraversion	0	Affected	Control	-0.29	0.18	0.13	-0.66	0.09
	1	Affected	Control	-0.33	0.13	0.02	-0.59	-0.07
SocialSelfEsteem	0	Affected	Control	-0.22	0.21	0.29	-0.64	0.19
	1	Affected	Control	-0.24	0.15	0.11	-0.53	0.05
SocialBoldness	0	Affected	Control	-0.19	0.31	0.54	-0.82	0.43
	1	Affected	Control	-0.36	0.22	0.11	-0.80	0.09
Sociability	0	Affected	Control	-0.53	0.25	0.04	-1.02	-0.03
	1	Affected	Control	-0.37	0.18	0.04	-0.72	-0.02
Liveliness	0	Affected	Control	-0.19	0.27	0.48	-0.74	0.35
	1	Affected	Control	-0.34	0.19	0.08	-0.73	0.04
Agreeableness	0	Affected	Control	-0.01	0.20	0.97	-0.41	0.39
	1	Affected	Control	-0.11	0.14	0.44	-0.39	0.17
Forgiveness	0	Affected	Control	-0.36	0.30	0.24	-0.97	0.25
	1	Affected	Control	-0.16	0.21	0.47	-0.59	0.27
Gentleness	0	Affected	Control	0.03	0.27	0.92	-0.52	0.57
	1	Affected	Control	-0.12	0.19	0.53	-0.51	0.26
Flexibility	0	Affected	Control	0.14	0.27	0.61	-0.41	0.69
	1	Affected	Control	0.20	0.19	0.30	-0.19	0.59
Patience	0	Affected	Control	0.17	0.33	0.61	-0.49	0.82
	1	Affected	Control	-0.36	0.23	0.12	-0.83	0.10
Conscientiousness	0	Affected	Control	0.04	0.13	0.80	-0.23	0.30
	1	Affected	Control	-0.02	0.10	0.86	-0.21	0.17
Organization	0	Affected	Control	0.06	0.22	0.81	-0.39	0.51
	1	Affected	Control	-0.06	0.16	0.71	-0.38	0.26
Diligence	0	Affected	Control	0.06	0.22	0.80	-0.38	0.50
	1	Affected	Control	-0.21	0.16	0.17	-0.53	0.10
Perfectionism	0	Affected	Control	-0.06	0.34	0.87	-0.74	0.62
	1	Affected	Control	0.13	0.24	0.59	-0.35	0.61
Prudence	0	Affected	Control	0.08	0.17	0.62	-0.25	0.42
	1	Affected	Control	0.08	0.12	0.50	-0.16	0.31
OpennesstoExperience	0	Affected	Control	-0.10	0.24	0.68	-0.57	0.38
	1	Affected	Control	-0.22	0.17	0.20	-0.56	0.12
AestheticAppreciation	0	Affected	Control	-0.25	0.36	0.49	-0.97	0.47
	1	Affected	Control	-0.38	0.25	0.14	-0.89	0.13
Inquisitiveness	0	Affected	Control	-0.03	0.22	0.90	-0.47	0.42
	1	Affected	Control	-0.04	0.16	0.81	-0.35	0.28
Creativity	0	Affected	Control	-0.19	0.40	0.63	-0.99	0.61
	1	Affected	Control	-0.38	0.28	0.19	-0.94	0.19
Unconventionality	0	Affected	Control	0.08	0.30	0.78	-0.52	0.69
	1	Affected	Control	-0.09	0.21	0.68	-0.52	0.34

Based on estimated marginal means. In the column labeled sex 0 refers to female, and 1 refers to male.

^b Adjustment for multiple comparisons: Bonferroni.

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