Investigating Stress and Coping During Practice and Competition in Tennis using Think Aloud

Abstract:

Aim: The purpose of this study was to examine stress and coping in both competition and practice in tennis and to further investigate gender difference using Think Aloud protocol (TA) in real-time.

Method: 16 (8 males and 8 females) competitive tennis players took part. A within groups design was implemented, and participants verbalised their thoughts between points of a championship tie-break during a practice and a competition condition. Data was transcribed verbatim, analysed for stressors (confidence, performance, external, physical) and coping responses (problem, emotion, avoidance) using deductive analysis. A CSAI-2R questionnaire was used to assess anxiety levels prior to practice and competition.

Results: CSAI-2R results showed cognitive anxiety significantly increased from practice to competition. Performance-focused coping (e.g., planning, technical) was verbalised most frequently in both conditions. Performance stressors (e.g., outcome, tactics) were verbalised most frequently in both conditions. Males verbalised significantly more performance stress in competition and physical stress in practice. Females verbalised external stress and utilize problem-focused responses more in competition than practice. Problem-focused coping was utilised most for males and females in both conditions.

Conclusion: Through the use of a novel data collection method (TA) this study provides context-specific findings within tennis, which support previous research in stress and coping where gender differences occur only for the type of stressor appraised. TA has also been found to be a viable method to assess stress and coping data in tennis. Findings can inform coaches, players, and psychologists about stressors and coping responses utilised during practice and competition.

Keywords: tennis, stress, coping, Think Aloud, gender.

Introduction

Research into stress and coping has been conducted in various sports, such as figure skating (Gould, Finch & Jackson, 1993), cricket, (Thelwell, Weston & Greenlees, 2007) golf (Giacobbi, Foore & Weinberg, 2004) and tennis (Puente-Diaz & Anshel, 2005) and have found a variety of stressors appraised by athletes in high pressure situations. The athlete's ability to cope with these stressors can have a significant effect on their performance (Lazarus, 2000), highlighting the importance of understanding stress and coping responses within sport. Stress has been defined as the "quality of experience, produced through a person-environment transaction, which through either over arousal or under arousal, results in psychological or physiological distress" (Aldwin, 2007, p. 24). The Transactional Model of Stress and Coping (TMSC) (Lazarus & Faulkman, 1984) is widely used within sport (Britton, Kavanagh & Polman, 2017; Burgess, Knight & Mellalieu, 2016; Nicholls & Polman, 2007). Nicholls and Polman (2007) carried out a systematic review on the stress and coping literature within sport and found the TMSC to be supported by 46 of 64 studies. Crucially, a significant interaction between stressors and coping responses was found, with the stressor experienced influencing the type of coping response the athlete utilised (Anshel, 1996; Anshel, Jamieson & Raviv, 2001).

The TMSC shows that coping in response to stressful events occurs in a series of stages. The first stage is the primary appraisal of the event. Lazarus proposed that we are constantly evaluating the environment around us during the process of cognitive appraisal. Our own experiences within the social and cultural environment will impact what an individual perceives as harm, threat and challenge. Harm refers to damage that has already occurred, threat refers to expectation of future harm and challenge refers to viewing stress in a positive way. These are the three types of primary appraisals that can cause the stress response to be elicited (Lazarus & Folkman, 1984). Once this has occurred, an individual will judge whether there are any actions that can be taken to reduce the source of appraisal and strive to change undesirable or distressing emotions (Lazarus, 1999). This is called the secondary appraisal, where coping responses occur to reduce the threat, harm or challenge that has been perceived in the environment. Secondary appraisal has an impact upon coping exhibited by the individual, and whether they believe there is anything they can do to reduce the stressor in the environment. Those who maintain good coping responses are less likely to appraise a situation as threatening primarily (Lazarus & Folkman, 1984).

Coping can be defined as "constantly changing cognitive and behavioural efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" (Lazarus & Folkman, 1984, p.141) and is crucial if athletes want to perform successfully in their sport (Haney & Long, 1995). Within sports, poor coping has been found to increase muscle tension and reduced focus (Anshel, Brown & Brown, 1993) demonstrating that effective coping mechanisms are integral to successful performance (Haney & Long, 1995). Furthermore, athletes in individual sports have been found to use more coping responses than athletes from team sports (Anshel, 2001; Holt & Hogg, 2002), showing it is important that specific sports are investigated.

Coping responses can be categorised into broader themes. The most widely used coping dimensions are problem-focused, emotion-focused and avoidance coping (Compas, Connor-Smith, Saltzman, Thomsen & Wadsworth, 2001; Nicholls & Polman, 2007). Problem-focused coping responses help to alter the stressful situation by eliminating the stressor (Lazarus & Folkman, 1984), whereas emotion-focused coping involves strategies to help the individual regulate emotional arousal and distress. Finally, avoidance coping consists of behavioural and cognitive efforts to disengage oneself from a stressful event (Kaiseler, Polman & Nicholls, 2012).

When moving from practice to competition, the pressure in the environment increases and the athlete can experience more debilitative anxiety leading to a performance decrement (Baumeister, 1984, Hill, Hanton, Matthews & Flemming, 2010). Few studies have researched differences in stress and coping between practice and competition (Nicholls et al., 2009), however, some have measured coping independently from stress (Crocker & Isaak, 1997). These findings demonstrate greater stability of coping responses in practice than competition in swimmers, and different coping patterns across competition and training sessions. In another study, Kerdijk et al. (2016) used interviews and self-report measures to investigate the influence of the social environment on stress and coping in hockey. Findings revealed that the context (competition or practice) was a factor in the choice of coping response, with problem-focused coping being the most frequently utilised coping responses in competition and avoidance focused coping, or no coping at all, was used most frequently in practice (Kerdijk et al., 2016).

Further considerations within the stress and coping literature have taken into account gender gender differences. Research suggests that stress and coping may differ between

genders, with male and female athletes using different coping responses during stressful situations (Kaiseler, et al., 2012; Nicholls & Polman, 2007). Kaiseler et al., (2012) investigated gender differences in stress, appraisal and coping in golf putting using TA. They found no differences in stressor intensities but found females reported task execution stressors (based on how the whole skill was executed) more frequently, in comparison to males, who experienced more outcome stressors (stressors based on the result of the point). Despite being in similar contexts, different stimuli in the environment were appraised as stressful between genders and the frequency of appraisals differed. For example, females reported more technique coping and self-talk to cope with task execution and outcome stressors whereas males utilised more external attribution for the outcome stressor. This suggests women are more likely to be task-orientated, whereas males are more likely to be ego-orientated (Kaiseler et al., 2012) due to differences in motivational orientation. Despite these findings, gender differences within sports are still not clearly defined, with some research reporting differences in coping, such as females using more coping responses at higher intensities (Tamres, Janicki & Helgeson, 2002) but without consistent patterns of results. Furthermore, some studies have found no evidence for gender differences (Kowalski, Crocker, Hoar & Niefer, 2005). Inconsistencies in these findings may be due to the larger context of stressors not being considered in respects to coping responses or due to the nature of the sport studied.

Two hypotheses have been widely used to explain why males and females may differ in their coping responses. The situational hypothesis predicts differences between genders disappear when in similar conditions, although differences are apparent across situations and social roles (Rosario, Shinn, Morch & Huckabee, 1988). The dispositional hypothesis predicts that gender differences in coping occur due to differing characteristics of males and females (Tamres et al., 2002). Kaiseler et al. (2012) found genders differ based on their different appraisals of the stressful event, with differences only found for the stressor types and not coping responses. This shows tentative support for the situational hypothesis, and supports previous research, that coping differs only in the stressor type when comparing genders (Lee-Baggley, Preece & DeLongis, 2005).

The only current research in stress and coping within tennis is by Puente-Diaz and Anshel (2005), this research identified sources of stress, appraisal and coping within tennis. Despite finding differences in stress and coping between cultures, only general stress and coping within tennis was investigated using a retrospective design. The retrospective nature of many studies within the stress and coping literature has been criticised due to a significant time

delay between experiencing stress and recalling how they coped (Nichols & Polman, 2007; Ntoumanis & Biddle, 1998), reducing the reliability of recalled data. However, Whitehead, Taylor, and Polman (2016) reported that Think Aloud protocol analysis (TA) can be used to better understand in-event cognitive processing in sport performance. Therefore, highlighting the potential for research to investigate real-time stressors and coping responses in tennis and reducing external bias that alters participants' recall of experience.

Few studies have directly focused on thought processes in tennis, with current literature only covering expertise, culture, differences in planning strategies and tactical skills in novice and elite players (del Villar, González, Iglesias, Monreno & Cervelló., 2007; McPherson, 2000; McPherson & Kernodle, 2007; Puente-Diaz & Anshel, 2005). McPherson and Kernodle (2007) employed recall interviews were participants would recall what they were thinking about between points and were asked 'what were you thinking about while playing that point?' These responses were verbalised into a cassette recorder which was situated at the back of the court. Findings revealed that varsity players exhibited fewer tactical concepts than professionals. Investigations into stressors and coping responses between practice and competitive play in tennis will expand the research area, as sources and types of stress in sport have been found to vary based on sport type (Anshel & Wells, 2000; Anshel, Williams & Williams, 2000; Goyen & Anshel, 1998). These findings may then shed light on how performance decrements can be reduced when moving into high-pressure conditions.

To reduce the memory decay issues surrounding retrospective methods, TA has been previously employed in sport research to investigate cognitive thought processes, in sports such as golf, distance running, cycling and snooker (Samson, Simpson, Kamphoff & Langlier, 2017, Whitehead, Taylor & Polman., 2016; Welsh et al., 2018; Whitehead et al., 2017; Whitehead et al., 2018). During TA, participants verbalise their thoughts throughout the task (Ericsson & Simon, 1980), allowing for a real-time capture of their thought processes to better understand cognition in sporting events (Whitehead et al., 2016). With the dominant research design within stress and coping in sport being retrospective, TA provides a methodology to gather real-time reports. Ericsson and Simon (1993) distinguished three levels of TA each identifying different amounts of additional processing required to produce vocalisation. Level 1 TA requires the individual to make no effort to communicate their thoughts as it is vocalisation of inner speech. Level 2 TA involves the explanation of information that is presentlty not in a person's focus of attention but must be recoded into verbal form before it can be reported. The explication or recoding involves additional processing but does not bring new information into the person's

focus of attention (Hertzum, Handsen & Anderson, 2009). Finally, Level 3 TA requires the individual to explain their thoughts, ideas, hypotheses, or motives. Level 3 has been criticised for potentially impacting performance, although this has recently been challenged. For example, Whitehead, Taylor and Polman (2015) found level 3 verbalisations do not lead to a performance decrement in golf putting.

The current study aims to develop previous literature by analysing the relationship between tennis players' stressors and coping responses during practice and competition, which to the authors knowledge has not been undertaken in previous literature, using a real time method such as TA. It is hypothesised that problem-focused coping will be the most frequently utilised in competition and avoidance coping in practice (Kerdijk et al., 2016). The secondary aim was to conduct a gender comparison on sources of stress and coping responses. It is hypothesised that, differences only found for the stressor types, not coping responses (Kaiseler et al., 2012; Lee-Baggley et al., 2005), supporting the situational hypothesis. Additionally, it is hypothesised that females will verbalise stressors relating to task execution, whereas males will verbalise more stressors concerned with the outcome, showing males to be more ego-orientated and females to be more task-orientated (Kaiseler et al., 2012).

Methods

Participants

16 participants took part in the study and were all part of a division 1 tennis league in the North West of England. All participants played competitively on average of once per week. Of the 16 participants (age: $M = 28.63$, $SD = 12.11$) 8 were males (age: $M = 20.75$, $SD = 0.66$) and 8 were females (age: $M = 36.50$, $SD = 12.99$). The study and protocol were approved by the authors institutional ethics committee and participants provided informed consent prior to data collection.

Materials

The study took place on a hard tennis court surface at the participant's home courts. Participants used their own racquets and new balls provided by the researcher. Olympus DM-650 digital recorders were used to gather real-time verbal data from participants between points. These were placed in the participant's pocket, with a small clip-on microphone attached to the shirt collar to ensure clarity of sound.

Prior to each condition, each participant completed the Competitive State Anxiety Inventory-2 Revised (CSAI-2R; Cox, Martens, & Russell, 2023) to check the competition manipulation. The CSAI-2R was used as the original CSAI-2 (Martens, Vealey, & Burton, 1990) has been criticised due to the original validation being based on small sample sizes and having poor structural validity (Cox et al., 2003). The CSAI-2R is a multi-dimensional domain-specific instrument to assess participants affect and cognitions about sporting situations (Lagos, Vaschillo et al., 2008). The 17 items within the CSAI-2R represent three subscales, including somatic anxiety, cognitive anxiety and self-confidence. Previous research has demonstrated high internal consistency for the CSAI-2R subscales (Lagos, Vaschillo et al., 2008). Participants are required to answer on a 4-point Likert scale ranging from "not at all" to "very much so." The cognitive anxiety and self confidence subscales are made up of 5 items and the somatic anxiety subscale is made up of 7 items. As instructed by Cox et al, (2003) each subscale score is to be obtained by summing, dividing by the number of items, and multiplying by 10, leading to the intensity score ranging from 10 to 40.

Prizes were required for the competitive condition to reflect a true competition. By winning their first match in the competitive condition they would win a tube of tennis balls, and the winner of the overall competition won a £20 Amazon voucher.

Procedure

Prior to the first condition, all participants were briefed on TA protocol (Ericsson & Kirk, 2001). Approximately one hour prior to the first condition, participants met with the first author and were taken through a series of non-sport specific TA practice tasks (Eccles, 2012; Ericsson & Kirk, 2001) in order to become accustomed to thinking aloud and were instructed to verbalise what they were thinking (TA Level 2). Tasks included: a) counting the number of dots on a page, b) a problem-solving task, and c) an arithmetic exercise. Participants then used TA during their tennis specific warm up and were able to gain clarification on the process and ask any questions prior to starting the actual task. The whole TA training process took between 20-30 minutes per participant and participants then began condition 1 within 30 minutes of TA training. The researcher was positioned out of direct view of the participants during the tasks. Participants were instructed to verbalise between points to reduce any interference with motor movement during skill execution (Schmidt & Wrisberg, 2004) and had "Think Aloud" written on their non-dominant hand to remind them to verbalise between points. Specific instructions

of "please think aloud between points, only say what you are thinking at the time, do not try to explain your thoughts" were given to each participant. Participants then competed in two conditions in a within groups design. Conditions were randomly counterbalanced (Whitehead et al., 2016). Participants were randomly allocated a same-sex partner whom they played against in both conditions to make sure the level of play was not having an effect on conditions. Prior to each condition participants completed the CSAI-2R (Cox, et al., 2003). In the practice condition, participants played points against their allocated opponent in singles, tiebreak formation without scoring. They were told that this was just "practice" and that they would not be required to report the score back to the researcher or any other person. Participants were asked to play for the average championship tie-break time of 20 minutes. This condition was designed to be non-threatening and non-competitive. All participants are members of the same team and they were comfortable and familiar with playing against one another. Additionally, participants were familiar with the courts and environment as it is their home training facility. In the competition condition, participants played against their allocated opponent in singles formation whilst scoring using championship tie-break rules. Within the competition condition the championship tie-breaks took between 12-16 minutes to complete and participants had the standard 20 seconds between points to verbalise their thoughts at the back of the court and be ready for the next point. Participants changed ends every 6 points with no reset period. In this condition, a competitive setting was created by notifying participants that a prize of a tube of tennis balls would be given to the winner of the championship tie-break. Participants were informed that the two players who won their competitive tie break with the biggest point's difference, would go into a final to receive a £20 Amazon voucher. However, the final was not recorded. The pressure manipulation phase of this study was similar to previous studies (Vine & Wilson 2010; Vine, Moore & Wilson 2011), in which they created cognitive anxiety through conducting a competition, where participants were informed the individuals with the best performance would receive a monetary prize. In addition, presentations for the winners occurred (Whitehead et al., 2016) and results were posted to the team's social media website to create a competitive environment.

Analysis

Following data collection, all audio files were transcribed verbatim with checks for relevance and consistency being made. Each transcript was subject to a line by line content analysis

(Maykut, Maykut & Morehouse, 1994) to identify stressors and coping responses during each condition using NVivo (2015) qualitative analysis software. Units of information were coded and put into categories in order for comparisons to be made between each condition. In a similar process to Kaiseler et al. (2012), verbalisations that were perceived as causing the participants' negative concern of worry or had the potential to do so were coded as stressors. Further, verbalisations where participants attempted to manage a stressor were coded as coping responses. Transcriptions were then coded and grouped into themes and general dimensions. In keeping with the majority of research in TA (e.g., Arsal, Eccles & Ericsson, 2016; Nicholls & Polman, 2008; Whitehead et al., 2017) a post-positivist epistemology informed this study. Consistent with this, inter-rater reliability was calculated to ensure rigour. The third author then acted as a 'critical friend' and discussions regarding coding data into themes occurred. The content analysis of verbalisations was both inductive and deductive. The first author identified verbalisations based on a coding scheme adapted from Kaiseler et al. (2012) for stressors (Table 1) and coping responses (Table 2). Stressors were split into four secondary themes (confidence, performance, external and physical) and coping responses where themes were split into three secondary themes (problem-focused, emotion-focused and avoidance coping), which have been widely used within coping literature (Kaiseler et al., 2012; Kerdijk et al. 2016; Nicholls & Polman, 2007). Coding themes used for stress and primary coping differed somewhat due to Kaiseler investigating a different type of sport (Nicholls, Polman, Levy, Taylor & Cobley 2007), and using aspects of self-report within the study.

Several statistical analyses were used for the current study. Given the research design and a small number of participants, a series of nonparametric Wilcoxon matched-pairs signed ranks tests were conducted to examine the differences in stress and coping responses between competition and practice conditions. Mann-Whitney U tests were used to investigate the gender differences in stress and coping responses per condition. To identify a possible interactional relationship between the condition and gender on stress and coping responses, a series of bivariate correlation analyses and multivariate analysis of variance (MANOVA) with bootstrap methods were conducted due to the nonparametric nature of the data (Konietschke, Bathke, Harrer, & Pauly., 2015). While an alpha level of .05 is recommended, a .10 alpha level of .10 were also considered, consistent with previous studies using small experiments (Weisburd, 2000). Additionally, Pearson's correlations were run in order to analyse the relationship between stress and coping responses in each condition and also between gender. The magnitude

of correlations was 0-0.3 being low, 0.31-0.5 being moderate and greater than 0.5 being high (Dancey & Reidy, 2004).

Insert Table 1 and Table 2 here.

Results

Competition Manipulation

A paired samples t-test with bootstrap method was carried out on the CSAI-2R questionnaire data. Analysis of the subscales revealed that there was a significant difference in cognitive anxiety, (t (15) = -2.43, p = .03) where participants demonstrated higher cognitive anxiety scores in competition (M = 21.37, SD = 7.78) in comparison to practice (M = 18.00, SD = 6.61). A further analysis of gender, revealed a significant difference for females in cognitive anxiety between practice (M = 17.50, SD = 5.11) in competition (M = 23.25, SD = 5.70), (t (7) = -2.48, p = .04). However, no significant difference was apparent for cognitive anxiety in the male participants (t (7), = -.88, p = .41).

A difference was found between the means for somatic anxiety in practice (M = 13.02. SD = 5.61) and competition (M = 15.57, SD = 5.77), however this difference was not significant (t (15) = -1.67; p = .12). When analysing genders separately, no significant differences were found for males (t (7) = -.15; p = .88) or females (t(7) = -2.11, p = .08)

No significant difference was found in the self-confidence subscale during practice (M = 27.37, SD = 3.77) and competition (M = 26.87, SD = 4.95), (t (15) = 0.30, p = .76). When analysing genders separately, no significant differences were found for males (t (7) = - .83, p = .42) or females (t(7) = 1.14, p = .29).

Total Verbalisations

Mean (SD) values for verbalisations of primary and secondary stressor themes are presented in Table 3. Table 4 provides the overall percentages of primary and secondary stressors verbalised during competition and during practice. This shows performance stressors to be the most frequently verbalised in both practice (80.0%; 100 out of 125 verbalisations) and competition situations (79.0%; 107 out of 134 verbalisations), with only marginal differences found between conditions. Overall, participants experienced performance-related stress, followed by external, physical, and confidence stressors. Wilcoxon signed-rank tests found

within-group differences in three of the secondary themes in stress responses, namely, goal endangerment, Z = 1.732, p = .083, lack of concentration, Z = 1.890, p = .059. When tested separately, male participants verbalised performance stressors more frequently (89.2% vs 71.0%) in the competition condition as opposed to the practice situation. Conversely, female participants experienced a greater level of external stress in the competition condition than the practice condition (18.8% vs 3.0%).

Insert table 3 and 4 here.

Mean (SD) values for verbalisations of primary and secondary coping responses are presented in Table 5. Table 6 provides the overall percentages of primary and secondary coping dimensions verbalised during competition and during practice. This shows problem-focussed coping to be the most frequently verbalised coping strategy in both practice (54.3%) and competition (59.3%), followed by emotion (40.1 & 37.7%) and avoidance coping responses (5.7% & 3.0%). Results from Wilcoxon tests indicated that there were within-group differences in increasing effort, Z = 2.374, p = .018, and venting emotion, Z = 1.992, p = .046. In comparison to the practice condition, both males and females increased efforts while females vented more emotion in the competition condition.

Insert table 5 and 6 here

Stress & Coping Responses

To examine the relationship between stress types and coping responses, Pearson's correlation analyses were carried out. Within the competition condition, correlations were conducted and indicated that there were significant associations between external stressor and avoidance coping (r = .52, p = .039), and physical stressor and avoidance coping (r = .77, p = .001), indicating that those who experience external and physical stressors are likely to employ avoidance coping strategies.

Person's correlation analyses in practice indicated avoidance coping was associated with the confidence stressor (r = .50, p = .050), implying that subjects who confront confidence stressors are likely to utilize avoidance strategies. In addition, there was a possibly meaningful association between emotion-focussed coping and the physical stressor (r = -.47, p = .065), indicating that those who more frequently utilize emotion-focussed coping would experience less frequent physical-related stress.

Gender Comparison

Total Verbalisations

Mean (SD) values of primary and secondary stressor themes for males and females can be seen in Table 3. Table 4 provides the overall percentages of primary and secondary stressors verbalised by males and females during each condition. In practice and competition, performance is shown to be the main stressor for both males and females. However, results indicate that males experience less performance stress in practice (70.7%) than in competition (89.2%) whereas females experience more in practice (88.1%) than competition (71.0%). Of the primary themes, performance is the most frequently verbalised for males in competition (61.5%) compared to practice (39.7%), and for females in practice (65.7%) compared to competition (43.5%).

Mean (SD) values of primary and secondary coping responses for males and females can be seen in Table 5. Table 6 provides the overall percentages of primary and secondary coping responses verbalised by males and females during each condition. In practice and competition, problem-focussed coping is shown to be the main coping response used for both males and females. However, females experience more problem-focussed coping in practice (59.8%) compared to competition (48.7%) whereas male problem focussed coping remained consistent across conditions (49.6% vs. 48.7%). In terms of primary themes, planning was the most frequently utilised for males in practice (32.2%) compared to competition (30.8%) and for females in practice (38.1%) compared to competition condition (37.8%).

Stress and Coping Gender Comparison

Mann-Whitney U-tests were conducted to investigate between subjects (i.e., gender differences) in stress and coping responses. In the practice condition, the two gender groups differed significantly from each other on performance stress, U = 10.00, p = .018, and external stress, U = 18.00, p = .099. Female participants experienced performance stressors more often than their male counterparts while male subjects experienced external stressors more frequently in the practice condition. Among the secondary themes of stress responses, the between group differences were also found with performance (U = 7.50, p = .009), opponent (U = 20.00, p = .064), and physical discomfort (U = 19.00, p = .095). Female participants verbalised a greater level of performance stress in comparison to their male counterparts while male participants verbalised a greater level of stressors in related to opponent and physical discomfort.

However, no group difference was found in both the primary and secondary themes of coping responses. In the competition condition, a group difference was found with physical stress, U = 20.00, p = .064. Additional gender differences were found with positive self-talk coping responses (U = 14.00, p = .053), and opponent-related stress (U = 20.00, p = .064). In all three cases, male participants exhibited a greater level of stress and coping responses in comparison to their female counterparts. Overall, results indicated that males perceived a greater level of performance stress in the competition situation while greater physical stress in the practice situation.

MANOVA with bootstrap method showed no main effect based on respondent's gender and play condition. However, similar to the results of Mann-Whitney tests, a 'Gender by Condition' interaction was found, $F(4, 25) = 3.45$, p = .022, Wilks' Lambda = 0.64, eta-square = .36. MANOVA results indicated a 'gender by condition' interaction effect on: Performance stress, $F(1, 31) = 5.36$, p = .028, $\eta^2 = 0.16$; physical stress, $F(1, 31) = 4.80$, p = .037, $\eta^2 = .15$; and external stress, $F(1, 31) = 4.38$, p = .046, $\eta^2 = .14$. Performance stress was reported more often by females in practice and males in competition. On the contrary, external and physical stress was more frequently reported by males in practice and females in competition. This was not found to be significant for the confidence stressor $F(1,31) = 1.34$, p = .257, $\eta^2 = .05$. No significant results were found when running MANOVA on coping responses.

To examine the relationship between stress types and coping responses, Pearson's correlation analyses were carried out on male and female data separately. Male stress and coping in both conditions combined shows significant associations between the physical stressor and avoidance coping (r = .789, $p < .001$). Female stress and coping in both conditions combined shows significant associations between physical stressor and emotion focused-coping (r = -.520, p = .039). In addition, there was a possibly meaningful association between emotion-focused coping and confidence stressor (r = .467, p = .068),

Discussion

Stress and coping in practice and competition

The primary aim of this study was to examine sources of stress and coping responses in practice and competition in tennis using TA. Results support the first hypothesis, that problem-focused coping is the most frequently utilised in competition. This is followed by emotion-focused and avoidance coping, which is consistent with previous research on coping responses in sport

(Kerdijk et al., 2016). However, problem focused coping was verbalised most frequently in practice therefore rejecting the hypothesis that avoidance coping would be verbalised most frequently in practice. The most frequently verbalised stressor in practice and competition was the performance stressor, followed by the external, confidence and physical stressor respectively. No significant differences were found in the frequency of the technical stressor between practice and competition. Performance stress, the secondary theme for technical stress, was found to be the most frequently occurring stressor, however an increase was not seen from practice to competition.

Additional findings show significant associations between external stressors and avoidance coping, as well as between the physical stressor and avoidance coping in the practice condition but not competition. This may indicate that players are trying to block out or forget about external distractions and physical discomfort during practice and has been found to be used by elite athletes when facing a stressor (Yoo, 2001). Within the competition condition, avoidance coping was associated with the confidence stressor. This suggests that participants who utilise avoidance coping more frequently experience fewer confidence stressors and this could be an effective coping response for athletes experiencing low confidence stressors. This finding contradicts previous suggestions in research, such as Roth and Cohen (1986) who argued that avoidance coping is more likely used when emotional resources are limited (e.g., a person has low self-esteem), therefore, this finding may have just been a short-term effect. However, further research is required as previous literature found no significant relationship between avoidance coping and confidence when experiencing performance slumps (Grove & Heard, 1997; Levy, Nicholls & Polman; 2011). Furthermore, athletes experiencing greater avoidance coping have been found to report greater cognitive anxiety (Hammereister & Burton, 2001) and therefore this may not be the most successful coping response to utilise.

Gender differences in stress and coping

The secondary aim was to conduct a gender comparison on sources of stress and coping responses. Results indicate that male tennis players perceived a higher level of external and physical related stress in the practice condition, whereas female players perceived higher levels of external and physical stress in the competition condition. In terms of performance stress, males experienced greater levels in competition, whereas females experienced greater levels in practice. Therefore, we can accept the hypothesis that gender differences occur only for the type of stress appraised, not the coping response. This supports previous gender comparisons

within the stress and coping literature in sport (Kaiseler, et al., 2012; Lee-Baggley et al., 2005) as well as the situational hypothesis. This suggests differences in coping responses between genders is due to males appraising the same situation differently to females (Rosario et al., 1988). The hypothesis that females will verbalise stressors of task execution more frequently, whereas males will verbalise more stressors concerned with the outcome, showing males to be more ego-orientated and females to be more task-orientated (Kaiseler et al., 2012) was not supported. Females did verbalise a higher percentage of outcome stressors and males verbalised a higher percentage of stressors based on task execution, however this was not significant.

Significant associations were found between the physical stressor and emotion-focused coping in females, supporting the common notion that females exhibit more emotion-focused coping responses (LaFrance & Banaji, 1992; Nicholls & Polman, 2007; Yoo, 2001). For males, there was a significant association between the physical stressor and avoidance coping. This supports previous findings that suggest males are more likely to deny a problem exists through avoidance-coping (Tamres et al., 2002). This suggests that when experiencing physical stress, males and females have a different preferred coping response. Females may experience greater emotion-focused coping due to common assumption that they may express emotion more frequently than men (Brody & Hall, 1993; De Fruyt, 1997), suggesting that gender socialisation theory may be in action. This theory predicts that men are more likely to cope with stressors by denying or avoiding the stressor as they are socialised to not express their emotions (Tamres et al., 2002). However, these differences in coping may be due to different appraisals of the stressor as found in previous sport psychology literature (Kaiseler et al., 2012), supporting the situational hypothesis.

Potential limitations and implications for future research

Overall, the manipulation check showed an increase in cognitive anxiety from practice to competition, but no significant differences in somatic anxiety and self-confidence. As cognitions were the primary measurement in the current study, this difference should be sufficient to identify a change in thought verbalisations between conditions. A strength of the current study is that using the CSAI-2R measures the intensity of anxiety within the environment during each condition. Situational aspects of stressors, such as intensity and controllability, have not been assessed in some research despite them being found to influence the individual's choice of coping response (Nichols & Polman, 2007). However, the CSAI-2R scale only measures the intensity of perceived somatic anxiety, cognitive anxiety and self-

confidence and does not specify the direction of which the participants interpret these symptoms (Jones, 1995; Hanton, Neil & Mellalieu, 2008). The direction has been suggested to be of greater importance to distinguish between group differences than the intensity of response (Jones & Hanton, 2001). Therefore, future research must look at the direction of competitive anxiety experienced in each condition in order to determine whether it is having a facilitative or debilitative effect upon performance. Furthermore, to assess the impact of a stressor and to ensure that a condition is eliciting higher levels of stress within participants, it is recommended that physiological variables are incorporated into future research (Whitehead et al., 2016). Such as heart rate monitors and or collecting salivary cortisol samples (Coetzee, 2011).

Despite differences in cognitive anxiety being found between conditions, tentative differences found between practice and competition could be due to the anxiety manipulation not being strong enough. Previous studies on stress and coping in sports have found differences, such as more intense stressors during competition (Nicholls, Levy, Grice & Polman, 2009). Though a competition situation was created using prizes and setting up an environment involving competitive characteristics, measurements of verbalisations during a real competition or with the use of greater monetary rewards may produce different results (Vine et al., 2011). One possible reason for tentative differences found between practice and competition despite an increase in cognitive anxiety can be explained by Individual Zones of Optimal Functioning (IZOF; Hanin, 1997, 2000). This states that individuals react to anxiety differently, with some performing optimally during high anxiety and some during low anxiety. Therefore, an increase in anxiety during competition may be facilitative for some players and not others leading to different stress and coping responses being elicited. To combat this in future research, a scale taking into account facilitative and debilitative anxiety should be implemented (Jones, Lane, Bray, Uphill & Catlin., 2005). Although cognitive anxiety may have been seen to increase significantly, this may have resulted in players experiencing facilitative effects. Therefore, some verbalised stressors may have the potential to increase performance not hinder it. This emphasises the need for athletes to be assessed individually on what facilitates their performance for future research.

It is important to acknowledge, specifically given the increasing literature on rigour within data analysis (Smith & McGannon, 2017) the potential limitations of using inter-rater reliability due to different coders utilizing the same text differently (Campbell, Quincy, Osserman, & Pedersen, 2013). Although this study has adopted a post-positive methodology, in line with previous TA literature, it is important to consider within future research, the

recommendations provided by Smith and McGannon (2017) and also Eccles and Arson (2017). These authors provide important suggestions for the use of alternative theoretical and philosophical lenses within this type of data moving forward. For example, Welsh et al, (2018) have provided an alternative approach to analysing this TA data in snooker.

Conclusion and practical implications

To conclude, findings show problem-focused coping as the most frequently utilised in tennis, supporting previous findings from other sports such as hockey (Kerdijk et al., 2016). Support for previous gender comparisons within stress and coping in sport has been found, showing gender differences occur only for the type of stress appraised, with differences in coping responses being due to different appraisals (Kaiseler et al., 2012; Lee-Baggley et al., 2005), and partial support for the situational hypothesis. The findings from this study extend the current stress and coping literature by examining an under-researched sport and utilising a novel method of TA. This study supports TA as a viable method to research cognitive thought and stress and coping in tennis. From a practical perspective, using TA to capture in event stress and coping responses can provide the coach and or the psychologist with extremely detailed accounts of how their athlete responds to stressors experienced in competition. In addition, although the competition was simulated, this process still demonstrated how a simulated environment can elicit higher or different stressors and responses, allowing for coaches and psychologists to gain access to this change in cognitive appraisal process in both males and females. This information should be taken into consideration by coaches or psychologists before coping interventions are implemented.

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