PERSPECTIVES AND PRACTICES OF ACCREDITED TENNIS COACHES WHEN DEVELOPING STROKE TECHNIQUE

Nicholas A. Busuttil[1], Alexandra H. Roberts[1], Marcus Dunn[2] & Kane J. Middleton[1]

Sport and Exercise Science, School of Allied Health, Human Services, and Sport, La Trobe University, Melbourne, Australia[1]
Centre for Sports Engineering Research, Sheffield Hallam University, Sheffield, United Kingdom[2]

The purpose of this study was to understand current international tennis coaching standards related to the development of specific grip positions in tennis and to explore tennis coaches' opinions on using physically constraining training tools for effective skill development. Accredited tennis coaches (n = 237) from 33 countries completed an anonymous online survey about their perspectives on the importance of grip positions for effective stroke development, and opinions on using physically constraining training tools for skill development. In the early stages of a player's technical development, training grip positions was ranked as the second most important aspect of foundational technique. This preliminary research indicates that while it is important for tennis players to develop a variety of grip techniques, the most commonly used are the Semi-Western (forehand), the combination of Continental/Eastern forehand (double-handed backhand), and Continental for the serve. It also demonstrated that 65.2 ± 23.7% of coaches would utilise a physically constraining tool to assist in developing tennis-specific skills. Using this information can guide future evidence-based biomechanical investigations to assess the effects of acute and longitudinal biomechanics of using physically constraining tools for tennis-specific skills.

KEYWORDS: tennis, grips, skill development, training tool, survey, coach.

INTRODUCTION: Grip positions in tennis are a vital component for effective strokes. Grip positions have been shown to affect upper limb angular and linear kinematics across a range of techniques (Elliott & Christmass, 1995; Busuttil, Reid, Connolly, Dascombe, & Middleton, 2020). Using a non-preferred grip position during the single-handed topspin backhand drive has resulted in greater shoulder abduction and elbow extension (shoulder: 64.7 ± 7.5°; elbow: 167.5 ± 5.7°) compared with a preferred grip position at ball impact (Eastern; shoulder: 60.5 ± 6.3°; elbow: 159.8 ± 5.2°; Elliott & Christmass, 1995). Similarly in the double-handed backhand, when using a continental grip for the non-dominant hand there is increased extension at the non-dominant elbow and wrist at impact (Elbow: 46.8 ± 20.1°, Wrist: -43.0 ± 16.7°) compared with the eastern grip (Elbow: 60.9 ± 20.3°, Wrist: -34.7 ± 16.0°; Busuttil et al., 2020). Additionally, the eastern grip position resulted in significantly greater racket head and ball velocity, with similar shot accuracy compared with the continental grip position (Busuttil et al., 2020). Despite the evident kinematic and performance differences between tennis grip positions, the importance and impact of adequate grip positions (a grip position that is constantly used) on the performance of youth and developmental-level athletes is currently unknown, as are the methods used by coaches to develop these techniques.

Coaches in many sports historically use training tools to enhance skill and technique development. Within tennis, training tools are physically constraining devices that purportedly promote kinematic adaptation to improve and streamline technique development (Busuttil, Roberts, Dunn, Connolly, & Middleton, 2021). For a developing tennis athlete, grip position instruction traditionally comes from their current tennis coach, training the selected grip position for a given stroke using the coach's preferred methodologies (e.g., semi-western grip position for the forehand stroke). A level of congruence between elite sprint coaches and biomechanists has been identified for variables that are important for effective sprinting technique (Waters,

Phillips, Panchuk, & Dawson, 2017), which indicates that coaches have significant, largely untapped resources of experiential knowledge. Utilising their knowledge, in combination with biomechanical based assessment technologies, can guide empirical evidence-based investigations to create ecologically valid environments to best represent the performance context of athletes (Greenwood, Davids, & Renshaw, 2012). Exploring the perceptions and practices of current accredited tennis coaches for grip positions and stroke technique methodologies provides the opportunity to develop practitioner-led, evidence-based biomechanical investigations of the relevant aspects of youth tennis development.
Therefore, the aim of this study was to understand tennis coach's' perspectives on the relative importance of different grip positions and their current perceptions of the utility of physically constraining training tools to influence overall stroke development.

METHODS: Two hundred and thirty-seven accredited international tennis coaches (Male 86.1%, female 13.0%, prefer not to disclose 0.8%; age: 41.1 ± 14.3 years; experience coaching: 15.5 ± 12.0 years) took part in the study. The study was approved by the La Trobe University Human Ethics Committee (#HEC20336), with implied consent given if the questionnaire was completed. Participants were recruited through email invitations sent to the national tennis organisations. Snowball sampling (Braun, Clarke, Boulton, Davey, & McEvoy, 2020), where individuals voluntarily forward on the questionnaire to their colleagues, was also completed for this project. Each participant completed a 15-minute, anonymous online questionnaire in REDCap (Research Electronic Data Capture), an electronic data capture tool (Harris et al., 2019). Participants answered questions in three sections: 1) background information including respondent demographics, tennis coaching experience, qualifications, and athlete demographics; 2) current practices and difficulties when teaching grip positions (e.g., "At what age do you think adhering to a grip position for tennis strokes becomes important for the student's development?"), and 3) participant opinions on the utility of a physically constraining tool for skill development. Descriptive and content analyses were performed on the data. Incomplete surveys were excluded from analysis.

RESULTS: The questionnaire reached a total of 33 countries, with most respondents (64.9%) from the United States of America, Austria, Australia, Slovenia and United Kingdom. Coaches primarily teach athletes between the ages of 7-14 (Table 1) and indicated that training grip positions was the second most important aspect during the early stages of development, with technique development being first (Table 2).

Table 1: Background information of tennis coach and student demographics.

Background information					
Athlete demographics	**Percentage (%)**				
Age group (years)	**3-6**	**7-10**	**11-14**	**15-17**	**18+**
	21.4	55.5	69.0	47.6	43.7
Ability level	**Beginner**	**Intermediate**		**Advanced**	**Elite**
7-10 years	48.8	35.4		12.6	3.1
11-14 years	8.2	48.7		34.2	8.9

Table 2: Ranking of common areas of tennis development by accredited tennis coaches.

Categories of tennis development	**Level of importance %**				
	Most (1)	**2**	**3**	**4**	**Least (5)**
Training grip positions	34.6	20.3	19.5	11.3	13.9
Physical conditioning	8.2	10.4	13.4	34.4	32.0
Technique development	42.4	38.5	13.4	5.2	1.3
Court movement	9.1	23.8	43.3	19.9	5.2
Match-play concept transfer	5.6	6.9	10.4	29.0	47.6

Twenty-seven percent of tennis coaches indicated that grip positions are difficult to teach to athletes, in addition to technique development (39.7%) and transferring concepts from training to match-play (44.5%). Approximately three quarters of tennis coaches (77.4%) believed that a grip position must be adhered to by the age of 10. For the coach's instruction of grip positions, 93.9% teach the serve with the Continental grip. In the forehand, the Eastern forehand and Semi-Western grip positions are taught by 48.0% and 66.8% of coaches, respectively. In the double-handed backhand, tennis coaches predominantly train their athletes with the grip combinations (dominant/non-dominant hand) of Continental/Eastern forehand (54.6%) and continental/semi-western (27.5%). Across the three strokes (serve, forehand and double-handed backhand), a large percentage of coaches primarily teach their athletes these grip positions in the 7-10 years age group (Serve: 67.2%; Forehand: 55.9%; Backhand: 58.5%). Fifty-nine percent of tennis coaches indicated that when initially teaching grip positions, the athletes revert to their own preferred grip technique due to discomfort (54.8%), lack of grip strength (21.5%), the athlete refuses to (4.4%), out of habit (60.7%) and a lack of confidence (35.6%). Approximately half of the respondents (48.5%) indicated that they believed that using a physically constraining training tool would improve an athlete's ability to learn new grip positions. Many coaches (45.5%) also believed that a training tool would facilitate transfer of the new grip into match play and 65.4% of tennis coaches would readily use such a tool in their training.

DISCUSSION: The present study explored the perspectives and practices of accredited international tennis coaches regarding the development of different grip positions in youth athletes. Developing stroke technique is considered an important aspect for injury prevention and effective stroke production in tennis performance literature. Expectedly, training grip positions and technique development were indicated as the most important aspects during the early stages of development. Due to the complex and dynamic nature of tennis specific skills, effective stroke production has been associated with a coordinated kinetic chain, efficiently transferring kinetic energy through linked body segments (Elliott, 2006). This may indicate that tennis coaches have a general understanding of key kinematic variables for developing and producing effective tennis techniques. This possibly emphasises that their experience coaching in youth athletes has revolved around the concepts of grip positions and stroke technique. Previous qualitative research in elite sprint coaches revealed that they intuitively expressed ideas consistent with recent empirical knowledge in training program designs, and key biomechanical variables associated with maximal velocity sprinting technique (Greenwood et al., 2012; Waters et al., 2017). Without further investigation into the experiential knowledge of developmental tennis coaches, the relationship between grip positions and stroke technique, and why it is considered most important during early staged development remains unexplored.

Holding an adequate grip position is important for consistent and strong ball/impact positions, as force of ball impact often creates a reversal of pre-impact wrist angular velocity (Knudson & Bahamonde, 2001). Coaches self-categorised their athletes as beginner and intermediate standards between the ages of 7-14 (~50%; Table 1). It was also indicated that 59% of tennis coaches believed that the athletes do not adhere to their instructed grip position during training sessions. The eastern forehand and semi-western grip positions (which are most taught grip positions by the coaches of the current study) when compared with the western and continental grips have reported greater racket head and subsequent ball velocity, while maintaining shot accuracy in down the line and cross court directions (Elliott, Takahashi, & Noffal, 1997; Busuttil et al., 2020). As shown in previous research, adjusting to a new grip position technique causes the hand to hold the racket handle in different joint wrist rotations at peak backswing and impact (Elliott & Christmass, 1995; Elliott, Takahashi, & Noffal, 1997; Busuttil et al., 2020). This possibly changes the recruitment patterns of the forearm muscles (Richards, Olson, & Palmiter-Thomas, 1996), possibly causing a reduced grip strength in unfamiliar grip position. Since the wrist is the first major upper limb joint for absorbing ball impact force (King, Glynn, & Mitchell, 2011), the new grip positions may not have sufficient load bearing strategies, possibly

causing the athlete to revert to their original grip position. This is emphasised by the coaches' responses for the possible reasons why their athletes do not adhere to their grip technique instructions with habit, discomfort and lack of confidence being the major influences on inadequate grip position use.

Lastly, the use of a physically constraining training tool during coaching sessions is welcomed by approximately 65% of the cohort, however there are reservations about its' ability to help athletes retain and transfer the skill of a new grip position into match-play. Future research should focus on investigating the acute effects of physically constraining training tools on upper limb kinematics and stroke performance during common tennis strokes. Additionally, future research should investigate the long-term learning effects of physically constraining training tools, assessing and monitoring long term kinematic adaptation from training with a physically constraining training tool, and how the developed technique would transfer into match-play performance.

CONCLUSION: This study investigated the perspectives and practices of tennis coaches when developing different grips in a youth population. Coaches believe that the continental, semi-western and eastern forehand grip positions are the most important to learn, and that grips are the second-most important contributor to overall tennis stroke performance. Albeit evidence as to their efficacy, most tennis coaches would be open to using a physically constraining training tool to assist in teaching their preferred grip positions to athletes. Future research should aim to determine the acute kinematic effects of physically constraining training tools and establish the efficacy of these tools to teach grips to youth athletes.

REFERENCES

Braun, V., Clarke, V., Boulton, E., Davey, L., & McEvoy, C. (2020). The online survey as a qualitative research tool. *International Journal of Social Research Methodology*, 1-14.

Busuttil, N. A., Reid, M., Connolly, M., Dascombe, B. J., & Middleton, K. J. (2020). A kinematic analysis of the upper limb during the topspin double-handed backhand stroke in tennis. *Sports Biomechanics*, 1-19.

Busuttil, N., Roberts, A., Dunn, M., Connolly, M., & Middleton, K. (2021). The use of training aids for sport-specific skill development in racket and club sports: a scoping review protocol.

Elliott, B. (2006). Biomechanics and tennis. *British Journal of Sports Medicine*, 40(5), 392-396.

Elliott, B., & Christmass, M. (1995). A comparison of the high and low backspin backhand drives in tennis using different grips. *Journal of Sports Sciences*, 13(2), 141-151.

Elliott, B., Takahashi, K., & Noffal, G. (1997). The influence of grip position on upper limb contributions to racket head velocity in a tennis forehand. *Journal of Applied Biomechanics*, 13, 182–196.

Greenwood, D., Davids, K., & Renshaw, I. (2012). How elite coaches' experiential knowledge might enhance empirical research on sport performance. *International Journal of Sports Science & Coaching*, 7(2), 411-422.

Hamadani, R., & Coyne, C. (2019, November). Maximizing process and outcome data capture for a hospital-based health advocacy program using redcap (research electronic data capture) open source application. In *APHA's 2019 Annual Meeting and Expo (Nov. 2-Nov. 6)*. American Public Health Association.

Harris, P. A., Taylor, R., Minor, B. L., Elliott, V., Fernandez, M., O'Neal, L., McLeod, L., Delacqua, G., Delacqua, F., Kirby, F., Duda, N. S., & REDCap Consortium. (2019). The REDCap consortium: Building an international community of software platform partners. *Journal of Biomedical Informatics*, 95, 103208.

King, M. A., Glynn, J. A., & Mitchell, S. R. (2011). Subject-specific computer simulation model for determining elbow loading in one-handed tennis backhand groundstrokes. *Sports Biomechanics*, 10, 391–406.

Knudson, D., & Bahamonde, R. (2001). Effect of endpoint conditions on position and velocity near impact in tennis. *Journal of Sports Sciences*, 19(11), 839-844.

Richards, L. G., Olson, B., & Palmiter-Thomas, P. (1996). How forearm position affects grip strength. *American Journal of Occupational Therapy*, 50(2), 133-138.

Waters, A., Phillips, E., Panchuk, D., & Dawson, A. (2017). Coach and biomechanist knowledge of sprint running technique. In *35th Conference of the International Society of Biomechanics in Sports* (pp. 14-18). Cologne, Germany.