The EvoCourt Set: An Innovative Wheelchair Tennis-Specific Performance Uniform Designed for Women Athletes

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Keywords: Performance, Uniform, Adaptive, Wheelchair Tennis

Significance

Although wheelchair tennis is one of the fastest growing and most competitive wheelchair sports (International Paralympic Committee, n.d.), wheelchair tennis-specific performance uniform does not currently exist. Even at the Olympic level, wheelchair tennis athletes wear able-bodied tennis apparel, which includes tank tops, t-shirts, shorts, skirts, and dresses (D. Mathewson, personal communication, 2025). However, many of these pieces are ill-fitting for wheelchair tennis athletes because the garment proportions are designed for upright movement rather than seated. Skirts and dresses often get caught in the wheel rim and impede the task of propelling a wheelchair while playing tennis, which is inherently difficult because the racket must be held in the same hand (Rietveld et. al., 2021). The restrictive nature of the wheelchair not only inhibits lower body ventilation, but also women's need for enhanced moisture management. Female athletes have smaller sweat gland responses than male athletes during the same exercises (Ichinose-Kuwahara et. al., 2010). In addition to thermoregulation needs, many players typically insert a foam block or towel between their thighs to strengthen their base of support and relieve nerve pain (D. Mathewson, personal communication, 2025). Therefore, this research aims to design and develop a wheelchair tennis-specific apparel top and bottom solution that enhances mobility, stability, and moisture management for women athletes at the LA 2028 Paralympics. By pioneering such a performance uniform, this design research seeks to empower adaptive athletes to perform at their highest potential while feeling confident and supported, paving the way for athlete-informed, science-driven apparel innovations that redefine inclusivity.

Analysis and Synthesis

With limited current literature in wheelchair-compatible sportswear design, this work was grounded in user-centered design research (Norman & Draper, 1986). In an interview with the three-time Paralympian and the first American woman to win a Grand Slam title in Wheelchair Tennis, Dana Mathewson identified the greatest pain points and unmet needs in wheelchair tennis uniforms. While skirts and dresses (especially pleated designs) typically increase mobility for able-bodied athletes, the excess material restricts mobility for wheelchair athletes by getting caught in the wheels, causes thermal discomfort, and/or contributes to pressure ulcers (Agüera Fernández, 2023). High-waisted bottoms and tight-fitting tops further exacerbate thermal discomfort by trapping

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heat at the body's core and also draw unwanted attention to natural belly rolls. Shockingly, there is no support block on the market designed to provide stability for wheelchair tennis athletes; Mathewson made her own block out of yoga mats and a sweatband. Informed by these athlete insights, a thorough ideation process from sketching to draping and modeling in CLO 3D ensued, exploring silhouette, ventilation systems, and seam construction. The distinct performance demands of wheelchair tennis athletes inspired a design language centered around themes of asymmetry. The top garment needed an asymmetrical hem that is shorter in the front to remove excess material around the core. It also must be seamless to be distraction-free and allow for a comfortable range of motion. This was achieved with Bemis FlowFree double-sided adhesive, Bemis heat-bonded elastic binding trim, and bar tacks at high-stress areas for reinforcement to create a clean finish on both faces without introducing bulk. Drawn by tennis women's fashion and focused on inclusive design, any pleated details and the overall length of the bottom garment could not hinder the athlete-wheelchair interface. The bottom garment must also easily integrate removable foam padding between the inner thighs to strengthen their base of support. For its ideal breathability, lightweight, and moisture wicking properties, both the top and skirt are polyester mesh knit. The inner tights are 80% polyester/20% spandex blend with 96% nylon/4% spandex power mesh pockets to maximize ventilation.

Effect and Findings

By digitizing the pattern in CLO 3D, the simulation feature tests and visually validates the design's unique areas of fit with the sports wheelchair, particularly the skirt and around the athlete's core. The asymmetrical elements traversing through the top and bottom garments work together to create a stylish yet highly functional performance uniform. Following the princess lines with the Bemis heat-bonded elastic binding trim on the tank top's face side, these lines highlight the asymmetrical mesh paneling and add dynamism to showcase the strength of the athlete's movement. These lines continue to flow into the skirt bottom to create cohesion with the top, offer an overlapping asymmetrical panel to quickly wick hand sweat from the racket, and minimizes the surface area of the pleats to prevent interference with the wheelchair. As seen in the figure below, the pleats on the skirt are box pleats (sewn in place with 301 single-needle lockstitch) to maintain its shape and keep away from the wheelchair. This skirt is also backless to minimize layers of fabric against the seat, enhancing breathability and mobility. Since every athlete's support block is different, the built-in power mesh pockets lining the gusset allow them to seamlessly slip in their personal block for stability without worrying about it slipping. The loose fit around the core, the keyhole on the back, and the low V-shaped waistband improves ventilation evaporative cooling for the wearer. The top garment is also entirely seamless for anti-chafing, which further elevates mobility for the wearer.

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Future Work

The new performance uniform design received successful athlete feedback with great admiration for the ventilation details on the top, the box pleats on the skirt bottom, and the asymmetrical and dynamic styling using accent trims. Although the seamlessness of the built-in power mesh pockets to secure the support block was appreciated, the athlete viewed the purpose of their support block as a part of their equipment rather than their apparel. Thus, more information about the athlete's relationship with their support block should be considered in the future when revising this design solution. Finally, athlete wear testing while playing tennis in a hot environment should be conducted to objectively measure the performance of the ventilation features.

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Figure 1. Final physical prototype photography

Figure 2. CLO 3D model renders for visualization

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