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Application of Marker Data Sequences for Analyzing Nonlinear Breast Deformation

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Opinion

Excessive breast movement, particularly the displacement or deformation of the breast during physical activities, is not only embarrassing and dampens a woman's enthusiasm for participation, but also causes breast pain and irreversible damage, such as sagging [1]. The most effective solution for this problem is to wear breast support, which limits breast motion and reduces breast discomfort caused by breast movement [2]. However, the study of breast motion, particularly in the area of breast deformation during physical activities, is highly challenging. The difficulty lies in the unpredictable hyperelasticbehaviour of the breasts. Since the breast has no bone or muscle tissue to provide support, the fat tissues and ligaments contained in the breast are relatively free to move over the chest wall during torso motion [3,4].

Breast movement has often been decomposed into three movement directions: anterior–posterior, mediolateral, and vertical. However, breast movement is not limited to aforementioned displacements during activities. The 3D nonlinear and asymmetric deformation of the two breasts as a whole on movement analysis during exercises has not yet been addressed. More markers should be used to capture the shape in nonlinear 3D geometry, although it is a technical challenge and difficult to manage practically using optical motion capture technology. Studies have researched sports bra design based on movement analysis [5] and garment prototyping based on virtual human bodies [6] for design evaluation. Techniques on capturing cycles, subtleness, and characteristics of the human body [7] can also enhance the movement studies.

To analyze nonlinear breast movement by collecting ground-truth marker data of subjects performing physical exercise, one female participant with the breast size of 65C was invited to participate in the preliminary study. Because hormone levels can influence connective tissue within the breast, she was not breast feeding or pregnant, had no history of breast surgery, or any musculoskeletal disorder or pain that would inhibit her activity. Institutional ethical approval was obtained, and the participant provided informed consent before the experiment. The optical-motion capture system (Motion Analysis Corporation, USA) was set up at a controlled temperature of 19±0.5 °C and a relative humidity of 82±1%. The cameras were arranged around the participant, with a capture volume of 1m (L) X 1m (W) x1.7m (H) for treadmill running. To capture the left breast movement, 10 retro reflective markers were placed along horizontal breast outline while 9 markers were along vertical breast outlines. The participant was instructed to perform nude-breast running on a treadmill (T50X Matrix Fitness, USA) with a speed at 7km/h.

The marker displacement demonstrates that the movement of the breast is non-uniformed and multidirectional during vigorous running. This unsupported running movement caused the breast to move up-down, in-out and side-to-side randomly. The center front along the nipple point undergoes "creep" in and out when the breast is bouncing up and down. The markers on the entire breast did not behave uniformly. The changes in the distance vary along the vertical direction, ranging from 4.62% to 28.25%, whilst the change in the distance along the horizontal directional movement ranges from 7.42% to 18.17%. This elucidates potential deficiencies of the breast movement model regarding the representation of complex deformations during physical activities.

Experimentally obtained data sequences on breast motion from the participant suggest that breast movement and

deformation may exhibit nonlinear and asymmetrical patterns over time. Visualized data sequences predicted that breast motion amplitude differs in diverse breast regions. More data can be introduced to enhance breast motion analysis to construct a movement model. The novel marker data tracking could provide a fundamental guideline for an effective method of capturing breast movement with or without bra worn.

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

1. McGhee DE, Steele JR, Power BM (2007) Does deep water running reduce exercise-induced breast discomfort? Br J Sports Med 41(12): 879-883.
2. Steele JR (1999) Breast motion and sports brasserie design: implications for future research. Sports Medicine 27(4): 205-211.
3. Gehlsen G, Stoner LJ (1987) The female breast in sports and exercise. In: Adrian MJ (Ed.), Sport Women. Med Sport Sci Basel Karger, pp. 13-22.
4. Bowles KA, Steele JR, Munro B (2008) What are the breast support choices of Australian women during physical activity? Br J Sports Med 42(8): 670-673.
5. Zhou J, Yu W, Ng SP (2011) Methods of studying breast motion in sports bras: a review. Text Res J 81(12): 1234-1248.
6. Hlaing EC, Krzywinski S, Roedel H (2013) Garment prototyping based on scalable virtual female bodies. Int J Cloth Sci Tech 25(3): 184-197.
7. Lau N, Wong B, Chow D (2009) Motion segmentation method for hybrid characteristic on human motion. J Biomech 42(4): 436-442.

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