

スポーツ用義足は有利か不利か？ —走行中の関節スティフネス評価による検証—

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Advantage or Disadvantage? Dynamic Joint Stiffness During Running Using Running-specific Prostheses

by

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ABSTRACT

Recent technical developments of running-specific carbon-fiber prostheses with energy storing capabilities have allowed individuals with lower extremity amputation (ILEA) to compete at levels never before achieved. Additionally, running-specific prostheses (RSPs) have attracted more and more ILEA to running as a form of exercise and athletic competition. However, the advent of RSPs raised a debate in the scientific community regarding whether the RSPs provide potential advantages or disadvantages for ILEA as compared with able-bodied counterparts in running. In the present study, joint stiffness, which is the one of the determinants of running mechanics, was compared between intact and prosthetic leg at various overground running speeds in ILEA wearing RSPs. Eight ILEA performed overground running at a range of running speeds (2.5 to 3.5 m/s). Joint stiffness was calculated from kinetic and kinematic data in both intact and prosthetic limbs. We found that there were no significant differences in ankle and knee stiffness between the legs at all running speeds. Therefore, although we may never be able to quantify all the advantages and disadvantages of running using

RSPs, these results suggest that ILEA using RSPs would not receive any technical advantages during running.

要 旨

近年になって主流となっているカーボン繊維製のスポーツ用義足の登場は、障害者の積極的なスポーツ参加を促進させた一方、「義足の装着によって不当なアドバンテージを得ているのではないか?」という疑いの目を生じさせた。そこで本研究の目的は下肢関節におけるバネ機能の評価指標として広く用いられている Joint stiffness を評価することによって、スポーツ用義足の有利／不利に関する論争への視座を得ることであった。8名の片脚下腿切断者に、屋内に設置した一周100mの走路でランニング動作を行わせた。走速度は2.5 m/s, 3.0 m/s, 3.5 m/sの三段階に設定した。Torsional Spring Modelに基づき、関節モーメントを関節角度変化量で除して関節バネ特性 (Joint stiffness) を足関節および膝関節肢から算出し、義足側と非切断側と比較した。その結果、いずれの走速度でも義足側の足・膝関節スティフネスは非切断側と同等かそれ以下の値を示した。これらの結果は、カーボン繊維製のスポーツ用義足が国際陸連の懸念する「技術的措置による競技力向上」に繋がる可能性は低いことを示唆している。