Characterization of the Skin Penetration Aperture Site: Transfemoral Osseointegration Surgery Study Secondary Analysis

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Purpose: Transdermal, osseointegrated implants can improve function for patients with amputations who are unable to tolerate socket-based prostheses. However, little is known about the skin penetration site aperture (SPA), and there is no standardized grading scale to classify changes at the SPA after osseointegration surgery. Therefore, we sought to characterize the changes at the SPA and to develop a grading scale that may correlate with risk of superficial infection.

Methods: We characterized the SPA in 37 patients (51 limbs) who underwent transfemoral osseointegration surgery at 2 weeks, 3 months, 6 months, 12 months, and 24 months postoperatively. We graded the SPA using a modified Holgers grading scale consisting of ischemia, erythema, soft-tissue redundancy, granulation tissue, and fistula. Additionally, we calculated rates of superficial infection and used a correlation test to determine the relationship between the Holgers scale and infection rates.

Results: Ischemic changes at the SPA decreased over time from 98% postoperatively to 5% at 2-year follow-up. There were no significant changes in erythema or fistula formation, occurring in less than 5% of limbs. Soft-tissue redundancy and granulation tissue increased with 55% and 68% of limbs demonstrating these changes at 2 years, respectively. During the study period, there were 2 hematomas, 3 instances of skin necrosis, 4 limbs with soft-tissue redundancy requiring reoperation, and 7 wound dehiscences; however, only 3 (19%) of these complications involved the SPA. The overall infection rate was 35%, with 65% of patients without infection and 13% developing recurrent infections. The infection rate was 18% between stage-2 surgery and 2-week follow-up, steadily decreasing at subsequent follow-ups. Contrary to our hypothesis, we did not find a correlation between an increased Holgers classification score and infection at any time point.

Conclusion: We successfully characterized SPA changes using a modified Holgers grading scale. Soft-tissue redundancy and granulation tissue were common following surgery, whereas ischemic changes typically resolved over time. Soft-tissue complications and SPA infections occurred at lower rates compared to other studies. Assessment of intra- and interobserver reliability is planned for this modified grading scale, which could allow for improved, long-term surveillance.