

## **Microsurgery in the New Era of Managing Tissue Loss: Past, Present and Future of Replantation and Allotransplantation**

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Even though today replantation surgery has become a routine, it still remains a delicate and demanding surgery, which requires adequate expertise in microsurgical techniques. The indications for replantation procedures have been well established including formulated guidelines for digit, hand, upper extremity and lower extremity amputations. For cases that face more complex problems, the surgeon should be aware of other alternative techniques, such as transpositional microsurgery, various other secondary reconstructive procedures, and today the options of allotransplantation and tissue engineering. Although, overall, replantation procedures have been simplified, a second surgical team can save valuable surgical time by harvesting microvenous grafts, performing bone fixation or tendon repair among other things, while the chief surgeon focuses on revascularization. A number of sophisticated post-operative measures are now available to follow the replanted digit and are invaluable for the early identification of complications before they rapidly turn to an irreversible state. None-the-less, the presence of a member of the replantation team with the assistance of a nurse on a 24-hour basis is still widely accepted as the most beneficial means for avoiding an undesirable post-operative course of the replanted digit. Overall, the current aim which underlines the philosophy in digital replantation today is ensuring not only the survival of the finger, but more importantly its functional use as well. Experience dictates that this can be achieved only if the basic principles and indications are adhered to.

Transplantation of a vascularized limb or its components is defined as composite tissue allotransplantation. This new area in surgery has been made possible by the advent of microvascular surgery combined with advances in our knowledge of transplantation immunology. Hand transplants, as a composite tissue allograft, differ from solid organ transplants, since they consist of several types of tissue such as bone, muscle, cartilage, tendon, skin, nerves and vessels, with different antigenicities. As such, composite tissue allotransplantation (CTA) is faced by three major obstacles. The first obstacle is acute rejection, which is the most frequent complication of allotransplantation. Acute rejection occurs without exception at least once within the first year of transplantation and may lead to early graft loss. The second obstacle is chronic rejection, which is a poorly characterized process that occurs late after allotransplantation. The third obstacle is the necessary chronic immunosuppression, which may lead to drug side effects such as opportunistic infections, malignancies or organ failure. These three issues have dominated the debate in the hand surgery community regarding the life-enhancing benefits and ethics of human hand transplantation. In the modern era of immunosuppression, 24 hands have been transplanted onto 18 recipients to date. The outcomes of this procedure are still being determined. The ethical aspects of using chronic immunosuppression for a condition which is not life-threatening have also been debated in the surgical communities. Consequently, the future of hand transplants and other composite tissue allografts lies in the development of less toxic immunosuppressive drugs and/or safer methods of tolerance induction, such as chimerism.