A s major breakthroughs in upper-limb prosthetic technology continue to roll out in today’s clinical practice, two specialists in upper-limb prosthetics describe what has most impressed them—and what challenges remain.


The Otto Bock DynamicArm® elbow and microprocessor control system for transhumeral or higher limb loss/deficiency is the top choice for John Billock, CPO, CPO/L, FAAOP, executive/clinical director, Orthotics & Prosthetics Rehabilitation Engineering Centre Inc., Warren, Ohio. Billock says that before development of the DynamicArm with its multiple control options, he “was not a strong advocate for electric-powered elbows for persons with amputation or limb absence in the mid to distal one-third area of the upper arm.” Although he would like it to have more than two myoelectric controls—which he believes would provide more natural movements in a total-arm prosthesis than do two-site controls—he is impressed with the DynamicArms speed and lift—two features long desired by amputees.

Billock also likes the device’s software, which he describes as being user-friendly despite the complexity of its multiple control options.

“Regardless of this,” he adds, “I believe there is still a place for the simplicity of a hybrid Bowden-cable control and myoelectric two-site EMG muscle-control system. It still represents, in my opinion, the most effective way to achieve simultaneous control of a transhumeral prosthesis with a mechanical elbow and myoelectrically controlled hand.”

Billock notes another challenge in optimal functional design for transhumeral or higher-level amputations—the continuing absence of a “truly acceptable electric-powered wrist that provides at least 50 percent of the torque that is comparable to that of an electric-powered screw driver. The technology is there,” he says, “but just hasn’t yet made the priority list or drawing board of the manufacturers and developers.” However, he hopes future developments will address this deficiency.

Billock says he is excited about the technology being developed by the U.S. Department of Defense and the Defense Advanced Research Projects Agency (DARPA). He notes the pioneering work in targeted muscle reinnervation (TMR) surgery pioneered by Todd Kuiken, MD, of the Rehabilitation Institute of Chicago (RIC), Illinois, which complements various prosthetic technologies for high-level amputees. Billock agrees with Brenner that the i-LIMG Hand is another major advance, as is some emerging technology from Otto Bock HealthCare, Duderstadt, Germany.

Challenges

The number of new upper-limb amputees, apart from military casualties, has significantly dropped, Brenner points out.

“There are about 2,000 new patients per year with... continued on page 36