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Reconstructive Center for Lost Limbs

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## **Reconstructive Center for Lost Limbs**

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### **Multidisciplinary Approach to Amputation Care**

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At the OrthoCarolina Reconstructive Center for Lost Limbs (RCLL), we bring together a multidisciplinary team of experts to offer the latest advancements in surgical techniques and prosthetic technology. We view amputation as a reconstructive procedure aimed at maximizing limb function and minimizing discomfort, empowering individuals to regain mobility and independence. Our commitment is not only to address the physical aspects of limb loss but also to provide compassionate care that acknowledges the emotional and psychological impact it can have.

### **Comprehensive Monthly Clinics**

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Each month, our clinics are led by renowned orthopedic surgeons [Dr. Glenn Gaston](#) and [Dr. Bryan Loeffler](#). You will benefit from the expertise of prosthetists/orthotists, occupational therapists, and psychologists who work collaboratively to address every aspect of your care. From single-digit amputations to 4-limb amputees, our clinic offers innovative procedures tailored to your individual needs, including nerve-mediated pain management and cutting-edge techniques such as targeted muscle reinnervation (TMR), regenerative peripheral nerve interface (RPNI), the Starfish procedure, and targeted brain rehabilitation (TBR) using virtual reality.

### **Innovations from the OrthoCarolina Reconstructive Center for Lost Limbs**

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At the OrthoCarolina Reconstructive Center for Lost Limbs, we are at the forefront of pioneering techniques and treatments that significantly enhance the quality of life for our patients. Our innovative approaches are designed to address both the physical and neurological challenges associated with limb loss.

## CUTTING EDGE SURGICAL TREATMENTS: TARGETED MUSCLE REINNERVATION AND REGENERATIVE PERIPHERAL NERVE INTERFACE (RPNI)

In recent years, significant surgical advancements have been made to enhance prosthetic control for amputees. Nerve management strategies such as targeted muscle reinnervation (TMR) and regenerative peripheral nerve interface (RPNI) surgeries have helped to minimize nerve pain in the residual limb as well as enable better control of robotic limbs. Novel muscle transfers, such as the starfish procedure, have allowed the first patients in the world independent finger control of prosthetics. Prior to these innovative procedures, control of prosthetics was far inferior and much less intuitive and therefore patients abandoned prosthetics at a much higher rate.

### Starfish Procedure

The Starfish Procedure, developed in Charlotte, North Carolina by Drs. Gaston and Loeffler, enabled the first patient in the world to have independent finger control of a prosthetic. This procedure involves transplanting muscles from deep within the palm to the back of the hand where the signals can be detected by a prosthesis and intuitive control of each finger on the prosthesis is possible. This groundbreaking surgery was featured on [CNN](#), [Fox News](#), and [60 Minutes](#).

### Targeted Muscle Reinnervation (TMR) and Regenerative Peripheral Nerve Interface (RPNI) Procedures

Targeted Muscle reinnervation is a surgical procedure that involves using the cut nerve endings from an amputation to reinnervate other remaining muscles in the limb to both limit nerve pain in the arm and better control prosthetics. RPNI is a procedure in which the cut nerve endings from an amputation are wrapped with a muscle graft to prevent neuroma formation.

TMR and RPNI are frequently used in conjunction during complex amputation cases. These procedures can be used for a variety of amputation types including trauma, infection, and tumor. Through TMR, patients can experience significant improvements in pain management and functional outcomes, paving the way for enhanced quality of life post-limb loss. Drs. Gaston and Loeffler not only perform these surgeries on a routine basis, but also have a monthly clinic in which they teach visiting surgeons these techniques.

### Innovative Non-Surgical Techniques: Targeted Brain Rehabilitation (TBR) for Phantom Limb Pain Management Using Virtual Reality

Phantom limb pain is a common and challenging issue for amputees, with up to 80% struggling with this condition. This pain, often described as burning or clenching in the missing limb, results from the brain's response to the loss of the limb. Following the loss of a limb, the section of the brain that controls the missing limb becomes vacant and the void is filled with static "noise" which is perceived as pain.

Drs. Gaston and Loeffler, through the [OrthoCarolina Research Institute \(OCRI\)](#), are developing an evidence-based program known as Targeted Brain Rehabilitation (TBR) that uses Virtual Reality (VR) to heal this vacant section of



the brain. This innovative approach aims to prevent and treat phantom limb pain by addressing the neurological roots of the pain rather than masking it with medications.

Their ongoing study seeks to prove that targeted brain rehabilitation using VR can reduce phantom limb pain. [Preliminary results](#) are extremely encouraging, and their research has won grant support from the American Foundation for Surgery of the Hand. The combination of TMR to manage the residual limb pain and TBR to manage the phantom limb pain holds tremendous promise as the optimal pain management strategy for patients.

[Read more about Health Care Innovator Award.](#)

## Physicians

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Christopher Chadderdon, MD

**Christopher Chadderdon, MD**

**Physician**

Elbow, Hand, Trauma, Wrist

Glenn Gaston, MD

**Glenn Gaston, MD**

**Physician**

Hand, Elbow, Hand, Trauma, Wrist

Bryan J. Loeffler, MD

**Bryan J. Loeffler, MD**

**Physician**

Hand, Elbow, Hand, Shoulder & Elbow, Shoulder

Peter M. Waters, MD, MMSc

**Peter M. Waters, MD, MMSc**

**Physician**

Hand, Pediatric, Hand, Specialties, Fellowships, Pediatric

Julie C. Woodside, MD

**Julie C. Woodside, MD**

**Physician**

Hand, Elbow, Hand, Specialties, Fellowships, Trauma, Wrist

