Editorial Commentary: Large-Diameter Quadrupled Hamstring Autografts Are an Acceptable Option for National Collegiate Athletic Association Division I College Football Players: We Must Challenge Our Comfort Zone to Be Successful in the End Zone

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Abstract: The majority of surgeons caring for elite American football teams choose bone–patellar tendon–bone (BTB) autograft for anterior cruciate ligament reconstruction. As we strive to continue to improve currently favorable outcomes, we need to consider all options regarding graft choice, surgical technique, and postoperative rehabilitation. Advantages of BTB include an excellent track record, potential for faster incorporation with bone-to-bone healing. Disadvantages include risk of patellar fracture/tendon rupture and anterior knee pain. The pros of quadrupled hamstring (QH) graft include stronger graft (higher ultimate load to failure) and less anterior knee pain and stiffness, and the cons include loss of flexion/hamstring strength and slower healing in the tunnels. Several studies have shown that smaller grafts have higher failure rates, and recent research shows that QH grafts >9 mm had decreased risk of revision compared to BTB. We can now quadruple the semitendinosus tendon to provide elite athletes with even more robust grafts. Large-diameter QH autografts are an acceptable option for National Collegiate Athletic Association Division I college football players.

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A recent search on PubMed using the combined terms "ACL reconstruction", "patellar tendon", and "hamstring" resulted in 761 published articles on this topic. This controversial topic has been long debated and intensively researched in the literature over many years. Traditionally, we have learned that bone-patellar tendon-bone (BTB) graft for ACL reconstruction (ACLR) is the "gold standard". This teaching has been challenged many times. Over the years, our understanding of concepts expands, and there are advancements in our surgical techniques allowing "newer techniques" to provide more options for successful ACLR. Options include different grafts, different ways to drill, different fixation, and different postoperative management protocols, all to improve ACLR outcomes and return to play (RTP). Each option attempts to tarnish the BTB as the "gold standard".

In brief, the literature is vast with articles discussing the pros and cons of BTB and quadrupled hamstring (QH) grafts. The pros of BTB include its excellent track record, potential for faster incorporation with bone-to-bone healing and cons: risk of patellar fracture/tendon rupture, and anterior knee pain. The pros of QH graft include stronger graft (higher ultimate load to failure) and less anterior knee pain and stiffness, and the cons are loss of flexion/hamstring strength and slower healing in the tunnels.

Several studies have demonstrated that most orthopaedic surgeons caring for high-level football teams prefer BTB autograft for ACLR.[1,2,3] A study published in 2018 reported that 87% of National Football League team physicians preferred BTB to ACLR.[2] Another study of National Collegiate Athletic Association (NCAA) Division I team physicians published similar findings in 2016, with 12% of surgeons using QH and 83% of surgeons using BTB.[3] Regardless of these trends, there are

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not any studies that demonstrate that BTB is superior to QH in elite athletes.

One may question whether BTB is the graft of choice because athletes perform better, or it is "just the way we were taught". There are several considerations for a successful ACLR in a young, competitive athlete, including both graft type and graft size.

To challenge the norm/gold standard, it takes competence and guts.

I commend the authors of "Return to Play and Reinjury Rates in NCAA Division I Football Players Following Anterior Cruciate Ligament Reconstruction Using Hamstring Autograft"[4] for doing just that. Jeffers, Shah, Calvert, Lemoine, Marucci, Mullenix, Zura, Bankston, and Bankston have published a Level IV retrospective cohort study of QH autograft for ACLR in 34 NCAA Division I football players over a 15-year period by a single surgeon. The primary outcomes were ACL reinjury and return to play (RTP), which was defined as participation in an official NCAA or professional game after ACL reconstruction. The secondary outcomes evaluated were position played, eligibility after surgery, graft diameter, Tegner/Lysholm scores, concomitant injuries/surgeries and post-collegiate professional play. The results of this study showed that Division I NCAA football players with QH ACLR return to play at a rate comparable to that of BTB grafts reported in the literature.

This study was not without several limitations, which include the small sample size from a single surgeon caring for a single team, lack of a comparison group, limited statistical analysis, older surgical technique with transtibial drilling of the femoral tunnel, and older fixation methods.

Despite the limitations, the authors bravely defy the gold standard status of BTB and make us consider our options. As Albert Einstein once said, "If you always do what you always did, you will always get what you always got."

There are still many questions to be addressed with regard to optimizing ACLR. When comparing BTB to QH hamstring, I always think about BTB size as a measurement of width compared QH size as a true measure of diameter. Several studies have shown that smaller grafts have a higher failure rate. Grafts less than 8 mm have higher rerupture rates.[5,6,7] In this study, more than 50% of the grafts were less than 9 mm. Perhaps this is the greatest limitation/weakness? A recent publication analyzed 18,425 patients to determine whether revision rates were dependent on BTB and QH autograft size after ACLR. This study showed that QH grafts <8 mm had an increased rate of revision and grafts >9 mm had a decreased risk of revision compared to BTB.[7]

We can now quadruple the semitendinosus tendon and provide these elite athletes with even more robust grafts. Would this improve RTP rates and outcomes?

What about using an anteromedial portal or independent femoral guide with a potentially more anatomic femoral tunnel?

Would newer techniques and fixation methods help improve RTP and outcomes?

So many questions remain, and I task each of "us" to continue to challenge the norm.

Only by challenging the norm can we progress.

We must challenge our comfort zone to be even more successful in the end zone.

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