

The Peashooter Device: An Invaluable Tool for Bone Grafting During Revision Anterior Cruciate Ligament Surgery

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Abstract: Anterior cruciate ligament (ACL) reconstruction is a commonly performed surgery. Despite the improved technique and understanding of the rehabilitation rationale, the long-term success rate of good or excellent results is 75% to 90%. That leaves 10% to 25% of reconstructed ACLs with unsatisfactory results. Certainly, revision ACL surgery is not required in every patient. It should be individualized according to symptoms, objective findings, and the expectations of the patients. Revision of a failed ACL reconstruction may be carried out either as a single-stage procedure or a staged procedure. A staged procedure is recommended in cases of tunnel enlargement and/or removal of the implants and the failed graft, which leaves large bone defects. Bone grafting of the tibial bone tunnel defect is usually not a problem. On the other hand, grafting the femoral bone tunnel defect can present a challenge. It is important to place enough bone graft into the femoral tunnel securely and tightly so that bone incorporation takes place before the second-stage surgery, when the new tunnel can be drilled and the new ligament graft placed. We describe a simple technique using the elasticity and transparent properties of a chest drain, which effectively delivers the bone graft to the femoral tunnel defect. We name it the "peashooter device." **Key Words:** Revision—Anterior cruciate ligament—Bone graft—Tunnel enlargement.

Anterior cruciate ligament (ACL) reconstruction is a commonly performed surgical procedure. However, despite the improved technique and understanding of the rehabilitation rationale, the long-term success rate of good or excellent results ranges between 75% and 90%,¹ which leaves 10% to 25% of reconstructed ACLs remaining with unsatisfactory re-

sults. There are various causes of unsuccessful ACL reconstruction. It is true to say that not all failed ACL reconstructions require revision. However, some patients are suitable for revision ACL reconstruction because they have high physical demands and have symptoms of instability with clinically objective laxity.

Revision of the failed ACL construction may be carried out either as a single-stage procedure or a staged procedure. The staged procedure is recommended in cases of tunnel enlargement and/or removal of the previous implants and the failed graft, which leaves large bone defects.² There may be cases in which bone grafting the femoral tunnel is desirable as a first stage because of the large bone defects. One of the technical problems is in placing the bone graft in the femoral tunnel securely without dropping it into joint while manipulating it arthroscopically. Bone allograft is often chosen to avoid donor-site morbidity.

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The bone allograft needs to be handled with care because compacted bone allograft tends to be brittle and can crumble with excessive handling. We describe a technique using a chest drain as a chute to pack the bone graft into the femoral tunnel bone defect. We have found that the technique effectively delivers the bone graft to the bone tunnel defect and that it is easy to use.

SURGICAL TECHNIQUE

1. Remove fixation implants and the failed graft, and debride the tunnel if necessary.
2. Obtain a chest drain of appropriate size (10 to 11 mm is commonly used) and a metal rod of appropriate size as a trocar, and cut the chest drain to appropriate length (110 to 130 mm); slit the chest drain tip 2 to 3 mm longitudinally (Figs 1-3).
3. Prepare the bone graft from allograft (usually from the femoral head), or autograft if allograft is unavailable, and fashion it into a cylindrical shape if possible.
4. Place the bone graft into the chest drain tip via the slit (Figs 1-3).
5. Insert the chest drain tip into the bone tunnel defect, and pack the bone graft into the bone tunnel defect using the metal rod (Figs 4 and 5).
6. Repeat steps 3 to 5 until the bone tunnel defect is filled satisfactorily.

DISCUSSION

Despite the advances in the technique and rehabilitation of ACL surgery, we still face some unhappy patients with a failed ACL reconstruction. Certainly, revision ACL surgery is not required in every patient. It should be individualized according to symptoms, objective findings, and the expectations of the patients.

There are clinical situations in which bone tunnel defects are present in revision ACL surgery. Mechanical and biological causes have been attributed to the phenomenon of bone tunnel enlargement, which may not have immediate clinical significance, but the tunnel expansion is clinically significant in revision ACL surgery because the bone defects can often compromise the graft placement and fixation.³ In the presence of bone tunnel expansion, staged ACL revision is sometimes recommended with the initial bone grafting of the bone defect. There are occasional situations where the location of the implants is so tightly fixed



FIGURE 1. Diagrammatic representation of the concept of making the peashooter device.

Bone peg



Trocar



Chest Drain

FIGURE 2. Diagrammatic representation of the components of the peashooter device.

that removal of them may result in excessive bone loss, and thus necessitate a staged procedure.

Bone grafting of the tibial bone tunnel defect is usually not a problem, but grafting the femoral bone tunnel defect can present a challenge. It is important to place enough bone graft into the femoral tunnel securely and tightly so that bone incorporation takes place before the second-stage surgery, when a tunnel can be drilled and a new ligament graft can be placed. The technique we have just described is simple and effectively delivers the bone graft to the femoral tunnel defect. The elasticity of the chest drain with the tip slit enables easy placement of the bone graft and transfer to the desired site. We recommend making a slit at the tip because this facilitates the placement of the bone graft into the tube and we find that, with the slit, there is less resistance to transfer the bone graft from the tube to the tunnel defect. Another advantage

of this technique is that smaller pieces (by choice or accident) of the bone graft can still be used, placed within the tube, and directed to the bone tunnel defect easily. The transparent tube enables direct vision while placing the bone graft into the bone tunnel defect. Last but not least, the chest drain is easily available.

It is with fondness that many adult men recall making and enjoying the fun of a peashooter toy during childhood. According to the *American Heritage Dictionary of the English Language*,⁴ a peashooter is defined as:

A toy consisting of a small tube through which dried peas or other pellets are blown.

This simple toy is very effective in delivering a simple projectile. Nowadays, many grander toys achieve the same, but at greater cost. This simplicity was the reason we choose to name our home-made surgical tool after this toy. The same name was also used to name a revolutionary all-metal, single-wing fighter plane for

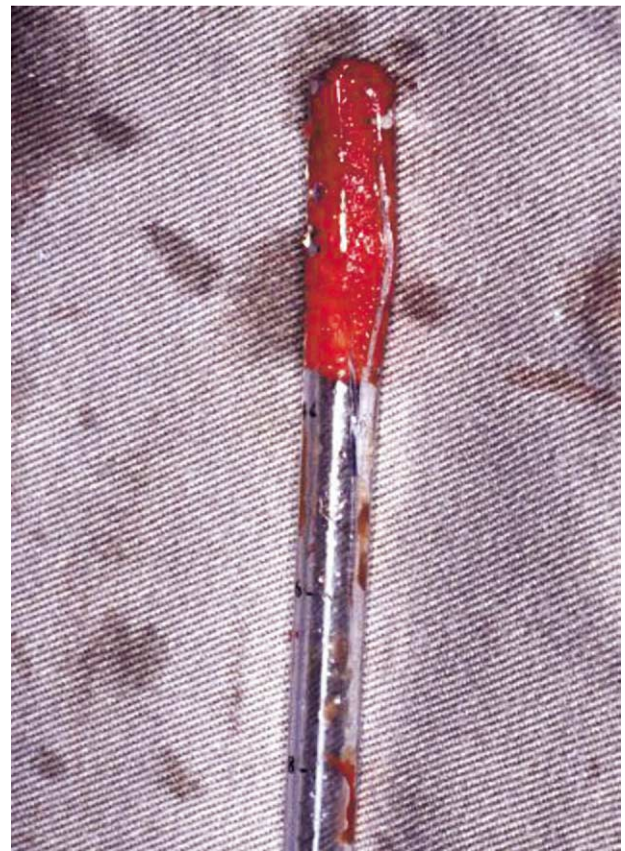


FIGURE 3. Photograph showing the bone graft within the chest drain tip and the metal rod used as a trocar

Boeing, known officially as the P-26 but more popularly known as the “Peashooter.” Harley-Davidson motorcycles also choose the same name for a revolutionary design in a 1930 model motorcycle. We hope this report will allow others to share how one particular step in revision ACL surgery can be simplified.

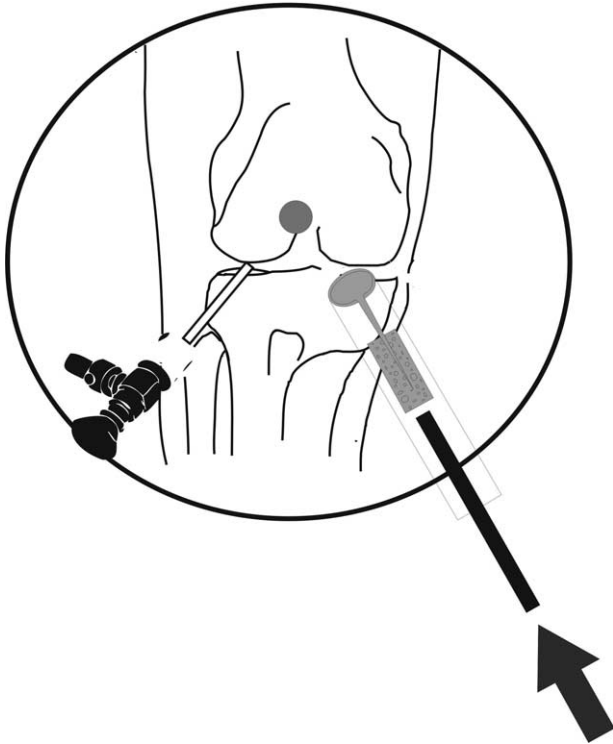


FIGURE 4. Diagrammatic representation of the operative arthroscopy using the peashooter device.

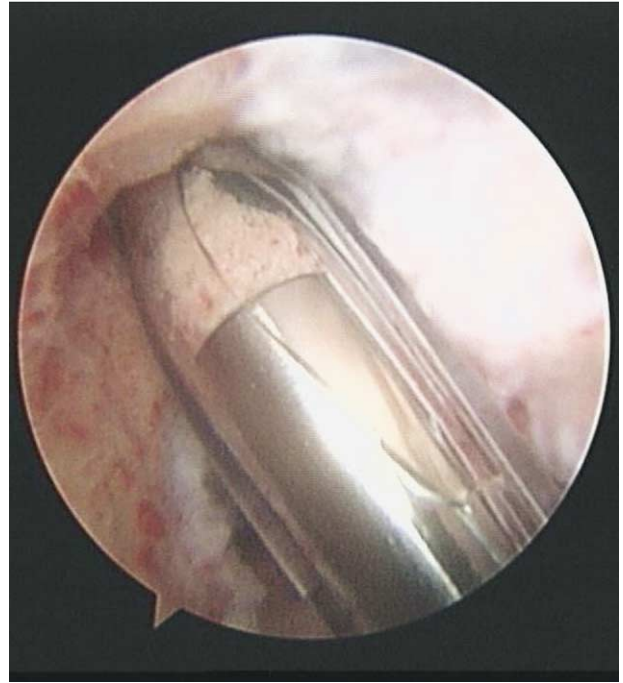


FIGURE 5. Photograph showing the bone graft being packed into the bone tunnel defect using the peashooter device.

REFERENCES

1. Harner CD. Editorial comment. *Clin Orthop* 1996; 2-3.
2. Safran MR, Harner CD. Technical considerations of revision anterior cruciate ligament surgery. *Clin Orthop* 1996; 50-64.
3. Wilson TC, Kantaras A, Atay A, Johnson DL. Tunnel enlargement after anterior cruciate ligament surgery. *Am J Sports Med* 2004; 32: 543-549.
4. American Heritage Dictionary of the English Language. Ed 4. Boston: Houghton Mifflin, 2000.