

## **The Impact of Biceps Tenodesis Techniques on Popeye Sign Incidence and Functional Outcomes**

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### **INTRODUCTION:**

Literature reports varied incidences of Popeye's sign in patients who underwent biceps tenotomy or tenodesis. This prospective study aims to clarify the frequency of Popeye sign and related outcomes of different tenodesis techniques in a large multicenter arthroscopic rotator cuff repair cohort.

### **METHODS:**

A cohort of 973 primary arthroscopic rotator cuff repair (ARCR) patients from several Swiss and German orthopaedic clinics was prospectively documented for up to 24 months postoperatively. All patients with ARCR plus biceps tendon treatment were included. Those with prior rupture or treatment of the biceps tendon were excluded. We assessed the Popeye sign occurrence one year postoperatively across groups treated either with tenodesis or tenotomy. A subgroup analysis was conducted to evaluate the frequency of Popeye sign and functional outcomes associated with various tenodesis techniques.

### **RESULTS:**

A total of 800 patients were evaluated, of which 55% (n=442) underwent tenodesis and 45% (n=358) received tenotomy of the long head of the biceps tendon. Mean age of the tenodesis group was significantly lower than tenotomy group ( $55 \pm 9$  and  $61 \pm 8$  years,  $p < 0.001$ ). The other demographics were comparable. Follow-up rate at 12 months for Popeye sign was overall 89%. Among the patients with tenotomy, 20% (n=71) developed a Popeye sign, compared to only 6.3% (n=28) in the tenodesis group (age-adjusted Relative Risk 3, 95% CI 1.9 to 4.8;  $p < 0.001$ ). There were no significant differences in shoulder function between the two groups. The subjective shoulder value (SSV) was slightly lower in the Popeye group ( $82 \pm 19\%$  vs.  $86 \pm 15\%$ ,  $p = 0.010$ ).

A subgroup analysis was performed with three most commonly used tenodesis techniques, including suprapectoral arthroscopic with anchor (SUP-A, n=194, 44%), subpectoral with anchor (SUB-A, n=99, 22%), and subpectoral cortical button (SUB-B, n=85, 19%). Incidence of Popeye sign differed notably among the three groups, with 9.8% (n=19) in the SUP-A group, 5.1% (n=5) in the SUB-A group, and 1.2% (n=1) in the SUB-B group.

The SUB-B group had an average SSV of  $89 \pm 12\%$  and a Constant Score of  $81 \pm 11$ , both higher compared to the other groups (SUP-A group: SSV  $86 \pm 16\%$ , Constant Score:  $78 \pm 12$ ; SUB-A group: SSV  $83 \pm 17\%$ , Constant Score:  $76 \pm 13$ ,  $p = 0.017$  and  $p < 0.001$ ).

### **DISCUSSION AND CONCLUSION:**

Patients with tenotomy of the biceps tendon are three times more likely to develop a Popeye sign compared to tenodesis. This was associated with a slightly worse clinical outcome, which might however be biased by older patients age. According to tenodesis technique, the subpectoral cortical button method resulted in the lowest incidence of Popeye sign and better functional outcomes. These findings highlight the importance of selecting the appropriate tenodesis technique to minimize Popeye sign and optimize patient outcomes in biceps tendon surgery.