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Electromyographic Analysis of Biceps Brachii during Golf Swing and Review of Its Impact on Return to Play Following Tendon Surgery

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Abstract : Introduction: The incidence of proximal biceps tenodesis and acute distal biceps repair is increasing, and rehabilitation protocols following both are variable. Golf is a popular sport within Australia, and the Gold Coast has become a Mecca for golfers, with more courses per capita than anywhere else in the world. Currently, there are no clear guidelines regarding return to golf play following biceps procedures. The aim of this study was to determine biceps brachii activation during the golf swing through electromyographic analysis, and subsequently, aid in rehabilitation guidelines and return to golf following tenodesis and repair. Methods: Subjects were amateur golfers with no previous upper limb surgery. Surface electromyography (EMG) and high-speed video recording were used to analyse activation of the left and right biceps brachii and the anterior deltoid during the golf swing. Each participant's maximum voluntary contraction (MVC) was recorded, and they were then required to hit a golf ball aiming for specific distances of 2, 50, 100 and 150 metres at a driving range. Noraxon myoResearch and Matlab were used for data analysis. Mean % MVC was calculated for leading and trailing arms during the full swing and its' 4 phases: back-swing, acceleration, early follow-through and late follow-through. Results: 12 golfers (2 female and 10 male), participated in the study. Median age was 27 (25 – 38), with all being right handed. Over all distances, the mean activation of the short and long head of biceps brachii was < 10% through the full swing. When breaking down the 50, 100 and 150m swing into phases, mean MVC activation was lowest in backswing (5.1%), followed by acceleration (9.7%), early follow-through (9.2%), and late follow-through (21.4%). There was more variation and slightly higher activation in the right biceps (trailing arm) in backswing, acceleration, and early follow-through; with higher activation in the leading arm in late follow-through (25.4% leading, 17.3% trailing). 2m putts resulted in low MVC values (3.1%) with little variation across swing phases. There was considerable individual variation in results – one tense subject averaged 11.0% biceps MVC through the 2m putting stroke and others recorded peak mean MVC biceps activations of 68.9% at 50m, 101.3% at 100m, and 111.3% at 150m. Discussion: Previous studies have investigated the role of rotator cuff, spine, and hip muscles during the golf swing however, to our knowledge, this is the first study that investigates the activation of biceps brachii. Many rehabilitation programs following a biceps tenodesis or repair allow active range against gravity and restrict strengthening exercises until 6 weeks, and this does not appear to be associated with any adverse outcome. Previous studies demonstrate a range of < 10% MVC is similar to the unloaded biceps brachii during walking(1), active elbow flexion with the hand positioned either in pronation or supination will produce MVC < 20% throughout range(2) and elbow flexion with a 4kg dumbbell can produce mean MVC's of around 40%(3). Our study demonstrates that increasing activation is associated with the leading arm, increasing shot distance and the late follow-through phase. Although the cohort mean MVC of the biceps brachii is <10% through the full swing, variability is high and biceps activation reach peak mean MVC's of over 100% in different swing phases for some individuals. Given these EMG values, caution is advised when advising patients post biceps procedures to return to long distance golf shots, particularly when the leading arm is involved. Even though it would appear that putting would be as safe as having an unloaded hand out of a sling following biceps procedures, the variability of activation patterns across different golfers would lead us to caution against accelerated golf rehabilitation in those who may be particularly tense golfers. The 50m short iron shot was too long to consider as a chip shot and more work can be done in this area to determine the safety of chipping.

Keywords : electromyographic analysis, biceps brachii rupture, golf swing, tendon surgery
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