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Abstract

Objectives: To use an objective metric of global function as a measure of outcome after cartilage cap resurfacing surgery for superior canal dehiscence. The Functional Gait Assessment (FGA) is an objective, standardized (age based normed), and validated metric of complex ambulation and walking tasks. The FGA has 10 items, and total scores range from 0 to 30.

Study Design: Prospective, controlled, non-randomized.

Methods: 42 patients who underwent cartilage cap resurfacing surgery had a pre-op baseline FGA study and a post-op FGA study at 3 – 6 months. In addition, 39 patients with superior canal dehiscence who did not undergo surgery had a baseline FGA study.

Results: For the surgical group, only 8 (19%) of 42 had a preop FGA score above their age based norm, and 34 (81%) had FGA below age based norm. For the non-surgical group, 23 (59%) had FGA above age based norm and 16 (41%) of 39 had FGA score below it. Postoperatively, 34 of 42 patients improved to age based norms (81%), 4 remained within age based norm (no change), and 4 had lower scores. 22 of the 34 (65%) who improved topped the FGA scale with a score of 29 or 30.

Conclusions: The objective assessment of the ability to walk and ambulate, as a reflection of dizziness in patients with superior canal dehiscence, improved significantly after cartilage cap resurfacing surgery.

Results

Of the 51 post-op patients with post op FGA, 42 had a pre-op FGA, 9 did not. Of those with pre-op FGA, only 8 (19%) had age appropriate FGA scores. Postoperatively, 34/42 (81%) improved their below age based norm FGA scores to above age based norm scores. Of the 9 who had only post-op FGA, 8 had a normal score. In addition, 22 patients scored 29 or 30 (maximum score of FGA is 30) on their post-op testing.

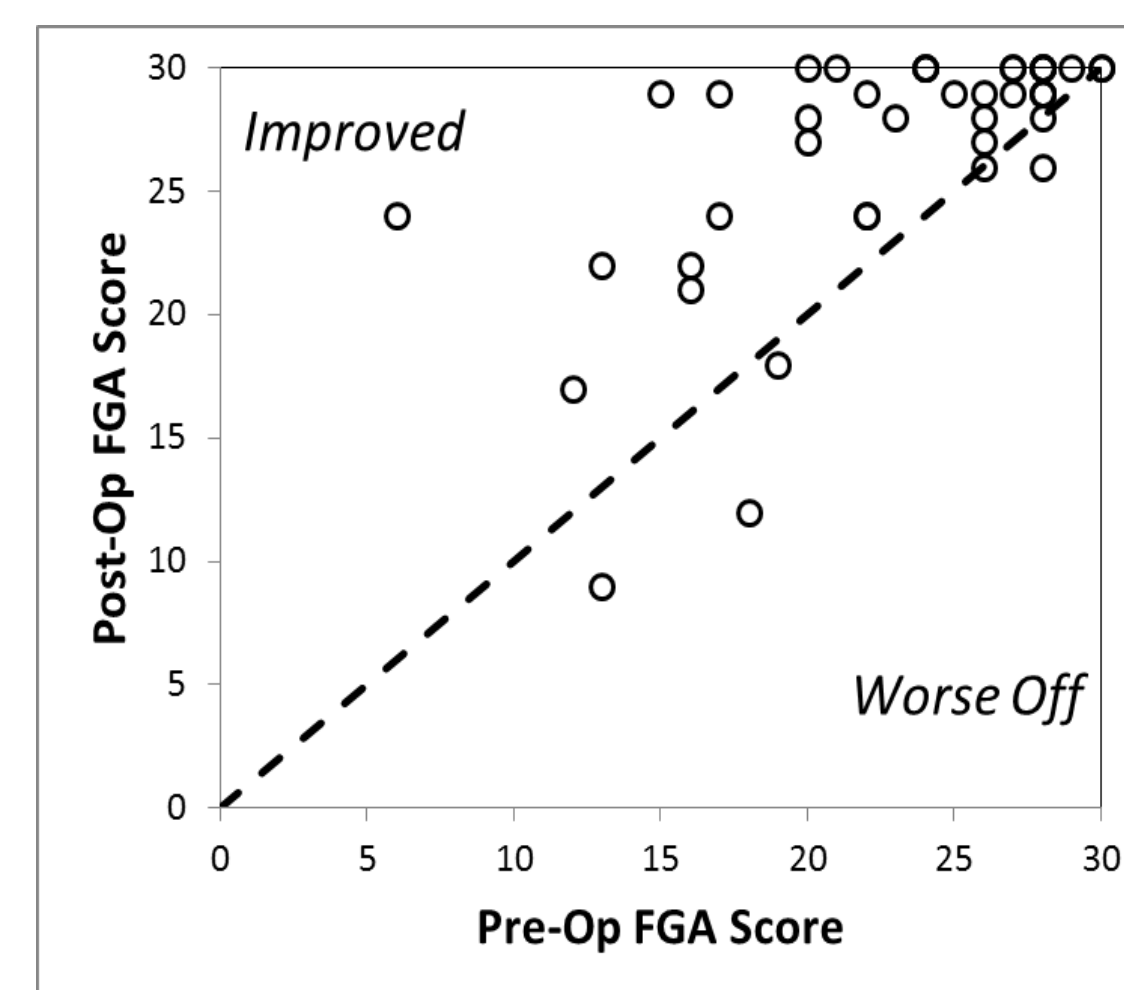


Figure 1. Pre-Op vs Post-Op FGA scores

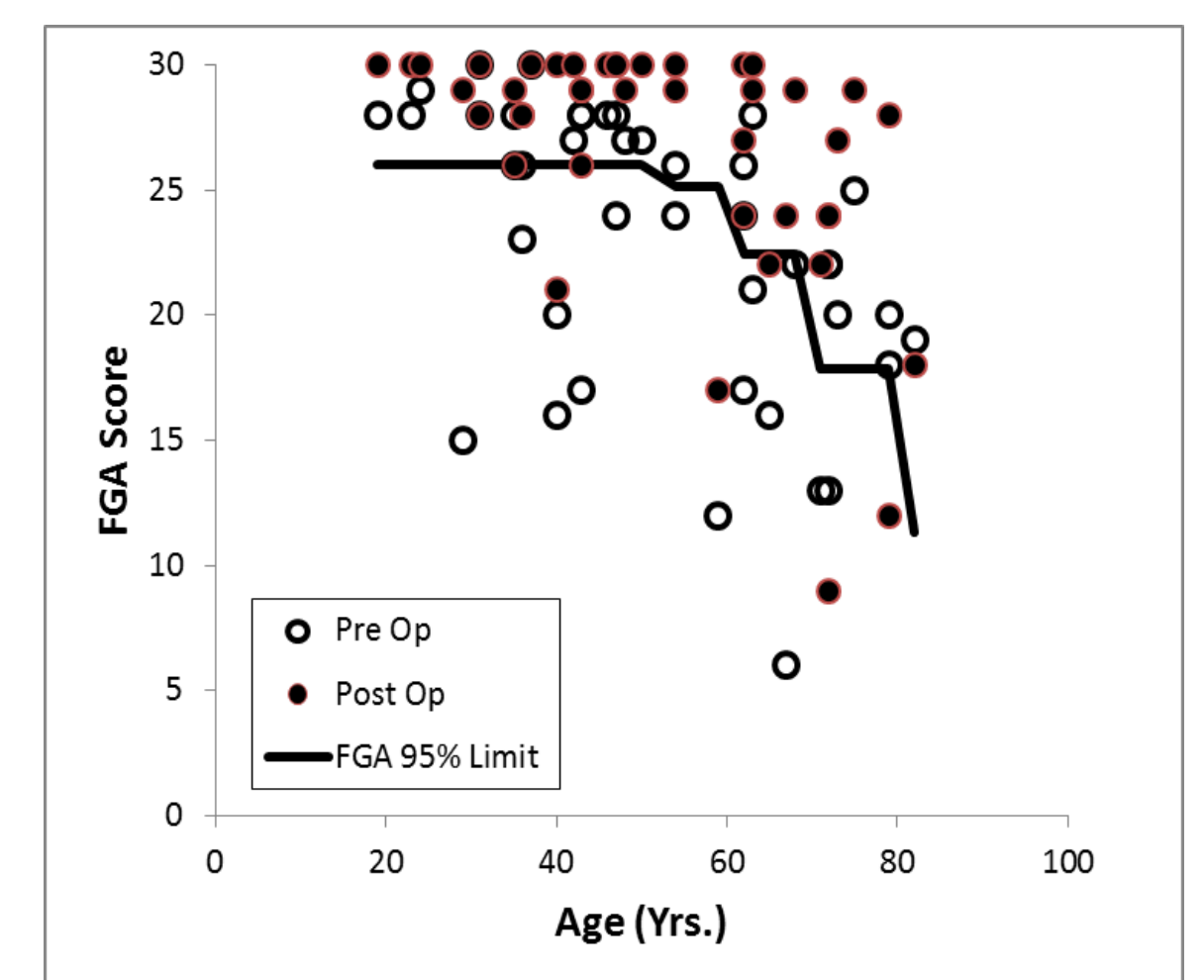


Figure 2. FGA Scores vs Age (norm by decade)

Introduction

Mechanisms of postural control, mobility, and ambulation are highly complex, and the vestibular system plays an integral role. Superior canal dehiscence is a well recognized¹, but poorly understood², pathologic condition that can certainly contribute to dizziness, and hence the ability to ambulate. Most reports in the literature regarding outcome for superior canal dehiscence surgery define results as 1) subjective self-report or 2) as subsets of audiometric and/or vestibular tests.³⁻⁷ There is no accepted metric for the overall impact of superior canal dehiscence on the patient's walking and mobility function. The Functional Gait Assessment (FGA) is an objective, standardized (age based normed), and validated metric of walking and ambulation for patients with vestibular disorders.^{8,9} The FGA measures 10 tasks of varying demands, such as walking with horizontal head turning, vertical head turns, eyes closed, backwards, etc. Cartilage cap resurfacing technique purposely avoids plugging of the canal.¹⁰ The FGA, as an objective metric, is applied to this surgical technique to help define outcome and success.

Methods and Materials

Between 2010 – 2016, 518 patients were diagnosed with SCD. 149 underwent cartilage cap resurfacing. This study includes 107 on which various data were collected, including FGA. 39 controls did not have surgery (20-78 yo, mean 55.5, 31 females, 8 males). 68 patients (19-82 yo, mean 51.2, 49 females, 19 males) underwent cartilage cap resurfacing surgery. 42 patients had both a baseline pre op and a post op FGA test. A baseline FGA was obtained before surgery decision was made. For surgical patients, the post op FGA was obtained at 3 – 6 months.

Table. Demographics

Group	Sex	Age (range, mean)	FGA baseline	FGA post op
Control (n=39)	8 M, 31 F	20 – 78 (55.5)	9 – 30 (25.5)	N/A
Surgical (n=42)	12 M, 30 F	19 – 82 (51.9)	6 – 30 (22.7)	9 – 30 (26.6)

Discussion

Outcomes for superior canal dehiscence surgery are primarily based on patient reports often as, symptoms “resolved” or “improved”. Objective results are reported as subsets of audiometric testing (air-bone gap, reflexes, etc.) or subsets of vestibular tests (change in VEMP amplitude and/or threshold, sound induced nystagmus, etc.).

No doubt subjective symptom reporting is important for the interpretation of outcomes, particularly in such a complex system as postural control and the vestibular function. However, patient reports for dizziness are recognized as unclear, inconsistent, and unreliable. To add to the understanding of the effect of superior canal dehiscence, with and without surgical intervention, an objective, overall assessment is needed.

Cartilage cap resurfacing surgery is specifically designed to avoid plugging of the dehiscence.⁹ Conchal or tragal cartilage is used because 1) it is pliable enough to conform to the arcuate eminence and surrounding middle fossa floor, 2) yet firm enough to avoid prolapsing into the superior semicircular canal, therefore sealing the bony defect and maintaining the integrity of the semicircular canal.

The Functional Gait Assessment (FGA) is a 10-item measure of complex walking tasks. The FGA has acceptable reliability, internal consistency, and concurrent validity with other measures of balance in patients with vestibular disorders. In this study, we demonstrated 34/42 (81%) of patients had an *improved* FGA score after cartilage cap resurfacing surgery. Of note is only 19% of the surgical group had age appropriate FGA scores, much poorer than the control, non-surgical group (59%). One potential weakness of this study using the FGA is there is likely a ceiling effect, and a more demanding test may help further stratify outcomes.

Conclusions

The Functional Gait Assessment, a test of complex and challenging gait and ambulation, demonstrated significant improvement after cartilage cap resurfacing for superior canal dehiscence. The FGA serves as an overall measure of baseline and outcome, and adds another perspective to commonly used patient self reports and focused audiometric and vestibular tests, particularly for patients with superior semicircular canal dehiscence.

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