Internal Rotation and Cross-Body Adduction after Reverse Shoulder Arthroplasty: Modes of In-Vivo Impingement are Different than Current In-Silico Simulations

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INTRODUCTION: Limited internal rotation (IR) and cross body adduction (CBA) can be a problem after reverse shoulder arthroplasty (RSA). Currently, bony or implant-related impingement can be evaluated with preoperative simulation software. However, these do not take into account soft tissue structures, most notably the conjoined tendon. It is also unclear if software simulated IR and AD correlate to clinical internal rotation and adduction. The present study sought to better evaluate in-vivo modes of impingement in IR and CBA after RSA.

METHODS: This is a retrospective review of a single surgeon's patients undergoing RSA from December 2021 through December 2022. Inclusion criteria were all patients who underwent RSA for osteoarthritis, massive cuff tear, cuff tear arthropathy, or inflammatory arthritis. Patients who underwent RSA for fracture, fracture sequelae, and revision were excluded. Patients with incomplete intraoperative data were also excluded. After placing the final implants, the treating surgeon evaluated the amount of motion and the mode impingement in three planes: IR in abduction (IRA), IR behind the back (IRB), and CBA. Implant factors such as glenosphere diameter, glenoid lateralization, humeral liner thickness, and humeral tray offset were recorded. An ordinal regression was performed to evaluate factors influencing IRB and CBA, and a multiple regression was performed for IRA.

RESULTS: Fifty-three patients were included in the study with an average age of 71.2 (±8.8). The primary mode of impingement for both IRA and IRB was impingement of the lateral aspect of the greater tuberosity (GT) on the conjoined tendon, 72% and 92% of the time, respectively (Table 1). The primary mode of impingement for CBA was the lesser tuberosity on the coracoid 79% of the time. On regression analysis, larger glenoid diameter negatively correlated with achievement of the highest levels of IRB (coefficient -.77, 95%CI -1.4 to -0.1, p=0.017) and CBA (coefficient -1.05, 95%CI -1.8 to -0.3, p=0.005).

DISCUSSION AND CONCLUSION: In this in-vivo study, IR in abduction and IR behind the back were both limited by the conjoined tendon while CBA was limited by bony impingement. Preoperative planning software and previous research on this topic has not accounted for these modes of impingement. Understanding the modes of impingement will improve the predictive ability of preoperative planning software and facilitate future studies that aim to improve IR and CBA.

Table 1. Modes of Impingement

		Coracoid	Conjoined Tendon
Internal rotation in Abduction	Lateral Greater Tuberosity	4%	72%
	Anterior Greater Tuberosity	0%	15%
	Lesser Tuberosity	0%	6%
	Bicipital Groove	0%	4%
Internal Rotation Behind the Back		Coracoid	Conjoined Tendon
	Lateral Greater Tuberosity	0%	92%
	Anterior Greater Tuberosity	0%	4%
	Lesser Tuberosity	0%	2%
	Bicipital Groove	0%	2%
Cross Body Adduction		Coracoid	Conjoined Tendon
	Lateral Greater Tuberosity	2%	0%
	Anterior Greater Tuberosity	0%	0%
	Lesser Tuberosity	79%	0%
	Bicipital Groove	19%	0%