Increase in Neck and Trunk Compensation to Complete Toileting Task Short Term After Anatomic Total Shoulder Arthroplasty

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INTRODUCTION: Glenohumeral osteoarthritis (GOA) can limit patients' abilities to perform activities of daily living (ADLs). Toileting is a mandatory ADL and can have serious implications on a patient's quality of life. It has been demonstrated that a variable predictive of patient satisfaction after shoulder arthroplasty is difficulty with toileting, typically due to limited internal rotation. To date, there have been no objective measurements of lumbar and pelvic compensation while performing a personal hygiene task in patients who have undergone anatomic total shoulder arthroplasty (aTSA). Thus, the objective of this study is to analyze pre- and post-operative neck and trunk compensation in patients with GOA who underwent aTSA while performing a personal hygiene task.

METHODS:

26 patients who underwent anatomic total shoulder arthroplasty for GOA were asked to perform a personal hygiene task captured by motion analysis pre-operatively and at their 3 and 6 month follow up. Subjects were asked to sit down and perform a hygiene task by reaching behind their backs to try and touch their sacrum (Fig 1). Patients were requested to complete the tasks at their comfort level without causing additional pain. If any patients had severe symptoms, they were asked to complete the test partially. Shoulder, lumbar, and pelvis kinematics were measured using human motion capture system (Vicon). Unadjusted descriptives were compared using Kruskal-Wallis and chi-squared tests for continuous and categorical variables respectively. These statistical analyses were conducted using Stata 16.1, StataCorp, CollegeStation, TX. A p value of <.05 was set for all analyses.

RESULTS:

26 patients were evaluated pre-operatively and 3-months post-operatively. 11 patients were evaluated 6-months post-operatively. There was statistically significant improvement in shoulder flexion ($55.56°$ vs $44.81°$, $p<.001$) and shoulder adduction ($22.16°$ vs $17.27°$, $p<.001$) at 3 months post-op. There was no significant difference in shoulder rotation at 3 months post-op compared to pre-op. However, all shoulder ROM angles improved at 6 month follow up while performing personal hygiene tasks. At 3 months post-operatively patients had increased cervical rotation ($10.33°$ vs. $7.25°$, $p<.0010$), lumbar flexion ($8.47°$ vs. $6.64°$, $p<.001$), lumbar rotation ($9.95°$ vs $6.71°$, $p<.001$), and pelvic rotation ($2.44°$ vs. $1.76°$, $p<.001$). At 6 months post-operatively, patients had increased compensatory motion compared to pre-op in cervical rotation ($9.19°$ vs $7.25°$, $p<.001$), lumbar flexion ($7.83°$ vs $8.47°$, $p<.05$), lumbar rotation ($9.05°$ vs $6.71°$, $p<.001$), and pelvic rotation ($2.41°$ vs $1.76°$, $p<.01$), however the amount of compensatory rotation decreased at 6 months compared to 3 months (Table 1).

DISCUSSION AND CONCLUSION:

The most important finding in our study was that patients had larger compensatory movements of their neck and trunk while performing a personal hygiene task at 3 and 6 months post-operatively compared to pre-operatively. Toileting tasks are a mandatory ADL and counseling patients on expectations on the ability to perform this task is important. The compensatory motions of the neck and trunk decrease from 3 to 6 months while patients see increased shoulder ROM, getting closer to their baseline ability to perform these tasks. This is the first study that objectively evaluates compensatory motions of the neck and trunk after aTSA while patients perform a toileting task.

Table 1: Kinematic compensation ROM during Personal Hygiene. * p<0.050, † p<0.010, ‡ p< 0.001.

Angle	Symptomatic				P value		
	Pre	Post 6w	Post 3m	Post 6m	Pre-Post 6w	Pre-Post 3m	Pre-Post 6m
Cervical							
Flexion	8.54 (7.23, 9.86)	9.20 (7.67,10.74)	8.60 (7.15, 10.05)	6.48 (4.71, 8.25)	0.440	0.939	**0.034***
Side-Flexion	4.72 (4.08, 5.36)	4.54 (3.83, 5.25)	4.12 (3.44, 4.80)	3.74 (2.96, 4.53)	0.581	0.055	**0.008†**
Rotation	7.25 (6.13, 8.37)	10.00 (8.74, 11.26)	10.33 (9.12, 11.54)	9.19 (7.78, 10.60)	**<0.001‡**	**<0.001‡**	**0.006†**
Lumbar							
Flexion	6.64 (5.90, 7.37)	7.86 (7.02, 8.70)	8.47 (7.67, 9.27)	7.83 (6.88, 8.79)	**0.006†**	**<0.001‡**	**0.017***
Side-Flexion	4.23 (3.76, 4.70)	4.09 (3.58, 4.61)	3.90 (3.41, 4.40)	3.65 (3.08, 4.22)	0.538	0.136	**0.025***
Rotation	6.71 (5.54, 7.89)	8.74 (7.49, 10.00)	9.95 (8.72, 11.17)	9.05 (7.71, 10.39)	**<0.001‡**	**<0.001‡**	**<0.001‡**
Pelvis							
Anterior Tilt	2.54 (2.16, 2.92)	2.50 (2.04, 2.95)	2.80 (2.37, 3.23)	2.65 (2.11, 3.19)	0.871	0.334	0.733
Obliquity	1.62 (1.36, 1.89)	2.01 (1.71, 2.32)	1.92 (1.63, 2.21)	1.62 (1.27, 1.98)	**0.026***	0.076	0.989
Rotation	1.76 (1.43, 2.08)	1.99 (1.62, 2.36)	2.44 (2.08, 2.79)	2.41 (1.99, 2.82)	0.212	**<0.001‡**	**0.002†**

Figure 1: Example of Personal Hygiene Task