

Introduction

- Over 600,000 upper extremity casts are placed each year in the United States.
- A large percentage of patients will drive with their cast in place.
- We felt the most notable potential danger to patient and society was in the ability to expeditiously turn a steering wheel in response to an obstacle
- Little research has been done into the quantitative mechanical deficit played by different types of upper extremity casting.
- This study aimed to quantify the potential deficit of various casts on the ability to apply force to a steering wheel.

Materials/Methods

- 8 healthy, right handed volunteers underwent isometric testing on a steering wheel attachment (figure 1) of a BTE2 simulator (Hanover, MD)
- Both left and right turns were measured at the following positions:
 - Neutral
 - 45 degrees counterclockwise
 - 45 degrees clockwise
 - 90 degrees counterclockwise
 - 90 degrees clockwise
- All positions were tested in the following immobilization for both left and right upper extremities:
 - No cast
 - Long arm thumb spica (**LATS**)
 - Short arm thumb spica (**SATS**)
 - Short arm cast (**SAC**)
- Measurements at neutral are shown independently.
- All other turns were pooled for analysis.

Figure 1



A seated volunteer at the BTE driving simulator

Statistics

- Statistical analysis was performed using SPSS software (IBM).
- Control versus cast was assessed with a Related Samples Wilcoxon Signed-rank test
- Median force generated, 95 % confidence intervals using 1000 bootstrap samples, mean percentage decrease for each casting type, and p values for the Wilcoxon Signed-rank test are reported for both left and right turns averaged over a turning cycle and the drivers' hands at neutral.

Funding

- No outside funding was obtained.
- All supplies were obtained surreptitiously from the Loma Linda University Department of Orthopedics.

Results

- At a neutral starting position, all right handed immobilization was found to have a detrimental impact on the ability to apply a turning force to a steering wheel (table 1).
- This was similarly seen when both the left and right turning cycles were pooled for analysis (table 2 and 3) (abbreviated for space).

TABLE 1. LEFT AND RIGHT TURN AT NEUTRAL HAND POSITION

	Median (N)	95 % Confidence Interval	Mean Paired Percentage Decrease	P value
NO CAST	252.4	160.1 – 306.5	-	-
L LATS	185.3	126.7 – 257.5	18.0	0.069
R LATS	158.9	126.0 – 239.6	24.0	0.017*
L SATS	192.1	140.4 – 290.2	11.5	0.208
R SATS	182.3	128.8 – 248.0	17.8	0.012*
L SAC	223.0	125.8 – 334.6	5.4	0.208
R SAC	190.1	138.0 – 255.1	12.3	0.017*

TABLE 2. LEFT TURN THROUGHOUT TOTAL TURN CYCLE

	Median (N)	P value
NO CAST	226.0	-
L LATS	166.7	0.012*
R LATS	136.7	0.012*
L SATS	207.9	0.123
R SATS	164.3	0.012*
L SAC	204.8	0.025*
R SAC	175.5	0.036*

TABLE 3. RIGHT TURN THROUGHOUT TOTAL TURN CYCLE

	Median (N)	P value
NO CAST	191.7	
L LATS	148.2	0.025*
R LATS	142.6	0.012*
L SATS	186.4	0.123
R SATS	167.1	0.012*
L SAC	199.7	0.161
R SAC	171.9	0.012*

Discussion

- Right handed casts were associated with significant deficits in the ability to apply force to a steering wheel from a neutral position.
- Both right and left long arm casting was associated with decreased ability to apply force to a steering wheel
- Drivers with upper extremity casts may exhibit a mechanical deficit in their ability to turn a steering wheel, especially with dominant or long arm casting.
- Physicians must be cognizant of this in discussions with immobilized patients.