TEMPORAL METHODS TO ESTIMATE THE DISPLACEMENT OF A CURLING ROCK: COMPARISON BETWEEN COMPETITIVE AND RECREATIONAL CURLERS

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The purpose of this study was to examine different methods used in curling to estimate the total rock displacement. A group of competitive (n=8) and recreational (n=8) curlers each delivered a total of 16 rocks, both guards and draws. Interval times for each delivery were measured from the back line to the near hogline and from the near hogline to the far hogline, and the average speed after release and the total rock displacement were determined. Pearson product moment correlations were calculated among the variables for each participant. The results of the study indicated that the various timing methods to estimate the total displacement of the curling rock are appropriate for competitive curlers, but may not provide accurate estimates for all recreational curlers.

KEYWORDS: curling, delivery, competitive, recreational

INTRODUCTION: One of the fundamental skills in the sport of curling is the delivery, in which the objective is to "throw" the rock so that it will eventually come to rest in a specific position at the opposite end of the sheet, or so that it will contact and remove an opponent's rock from play. Curlers attempt to deliver the rock with the appropriate speed and direction. The rock must be released with the required for the type of shot being played, whether it is a guard, draw, or take-out. Also, the rock must be delivered in the appropriate direction to allow for the proper amount of curl to complete the required shot (Bradley, 2009; Buckingham, Marmo & Blackford, 2006). It is the curling delivery which has the correct combination of speed and direction which will be most successful.
To assist curlers in successfully playing the required shot, various timing methods are often used to estimate the speed the rock is traveling and where it may eventually stop. This involves measuring the time required for the rock to travel specific distances as it moves down the ice as indicated by fixed lines on the playing surface. Timing will help determine whether or not it is necessary to sweep in order to extend and/or manipulate the path of the rock (Behm, 2007). One of these measurements is the time interval from the back line to the near hogline. A second frequently used measurement is the time interval between the near hogline and the far hogline (Figure 1.). Curlers measure these times during competitive play using a stopwatch.

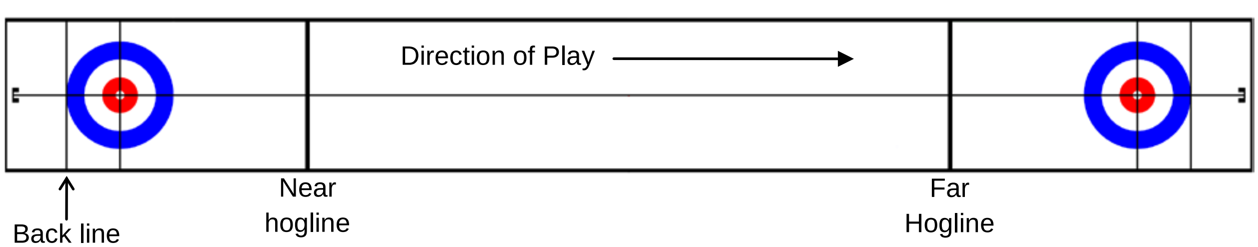

Figure 1. Time interval measurements in curling.

Curlers of all ability levels use these timing methods to estimate the "speed" of the ice and where the curling rock will eventually stop, however, no studies have examined these timing methods to determine their effectiveness or accuracy. In addition, it is currently not known whether or not these timing methods are appropriate for use by curlers of all levels, as the quality of the delivery often seen in less skilled curlers may influence the effectiveness of the timing. Therefore, the purpose of this study was to examine the different timing methods used in curling to estimate the total rock displacement. Comparisons were also be made between competitive and recreational level curlers.

METHOD: Sixteen curlers were recruited, eight competitive and eight recreational. The competitive curlers (mean age = 27.0 yrs; mean years of curling experience = 17.3 yrs) were players in the Major League of Curling in Thunder Bay, and played or practiced more than two times per week. This group included a number of athletes who have competed at provincial, national, and international events. The recreational curlers (mean age = 33.3 yrs; mean years of curling experience = 2.9 yrs) were individuals who played for various club teams in the city, and played or practiced one time per week or less. Ethical approval was received from the Lakehead University Research Ethics Board prior to data collection.

Participants were required to deliver sixteen rocks, eight draws and eight guards. Draw shots were those that stopped in the house; guard shots were those that stopped in front of the house. The deliveries were completed in random order, with equal numbers of in-turn and out-turn rotations. Timing of each curling rock was completed using a Brower wireless timing system (Draper, Utah). Interval times for each delivery were measured from the back line to the near hogline, and from the near hogline to the far hogline. In addition, a beam was located one meter past the near hogline and was used to determine the average speed of the rock after release. The total rock displacement was measured from the near hogline to the final stopped position using a measuring tape.

Data collection took place at the same curling venue but on multiple days and on different ice sheets. Because of this, it was not possible to control for the speed of the ice and ensure consistent test conditions for all participants. This prevented the data among the competitive and recreational curlers from being grouped for analysis. Pearson product moment correlations were calculated among the variables for each individual participant.

RESULTS AND DISCUSSION: Temporal data indicating the range (minimum and maximum) of the measured times and the speeds for rocks that were successfully delivered as guards or draws for all participants are presented in Table 1. Guards, which travel a shorter distance because they come to rest in front of the house, have longer back line to hogline times, slower rock speeds at release, and longer near hogline to far hogline times. In comparison, draws travel a further distance because they stop in the house. Accordingly, shorter back line to hogline times, faster rock speeds at release, and shorter near hogline to far hogline times are observed.

Table 1. Temporal and Speed Data

	Guard		Draw	
Variable	Min	Max	Min	Max
$\text{Time}_{(\text{back line - near hogline})}$ (sec)	3.44	4.11	3.38	3.83
Average speed at release (m/s)	1.89	2.22	2.00	2.33
$\text{Time}_{(\text{near hogline - far hogline})}$ (sec)	14.00	18.49	11.42	14.35

The results of the correlational analysis are presented in Table 2, outlining the range (minimum and maximum) of r values among the participants in each group. Statistically significant correlations were seen for all the competitive curlers among the temporal and displacement variables. Shorter back line to near hogline times were significantly correlated with faster average speeds at release, shorter near hogline to far hogline times, and greater rock displacements. Both the average speed at release and near hogline to far hogline time were also strongly correlated with rock displacement. For the recreational curlers, the results of the correlational analysis were more variable. While some of the recreational curlers demonstrated significant correlations for their deliveries similar to the competitive curlers, other recreational curlers did not. In particular, non-significant r values were seen for the three correlations associated with the variable average speed at release.

Table 2. Correlational Analysis

Correlation	Competitive		Recreational	
	Min	Max	Min	Max
$\text{Time}_{(\text{back line - near hogline})}$ - Average speed at release	-0.85 [a]	-0.95 [a]	-0.46	-0.93 [a]
$\text{Time}_{(\text{back line - near hogline})}$ - $\text{Time}_{(\text{near hogline - far hogline})}$	0.90 [a]	0.95 [a]	0.70 [a]	0.93 [a]
Average speed at release - $\text{Time}_{(\text{near hogline - far hogline})}$	-0.85 [a]	-0.96 [a]	-0.41	-0.97 [a]
$\text{Time}_{(\text{back line - near hogline})}$ - Rock displacement	-0.87 [a]	-0.94 [a]	-0.66 [a]	-0.94 [a]
Average speed at release - Rock displacement	0.89 [a]	0.98 [a]	0.23	0.96 [a]
$\text{Time}_{(\text{near hogline - far hogline})}$ - Rock displacement	-0.93 [a]	-0.99 [a]	-0.89 [a]	-0.98 [a]

[a] $p < 0.05$

A reliable delivery should be the objective of all curlers, whether they participate at a competitive or recreational level. Having the ability to deliver the rock so it is traveling in the intended direction with the appropriate speed will increase the chances of successfully completing the required shot. The results of this analysis indicate that statistically significant relationships were seen among the temporal variables associated with rock displacement in competitive curlers. These curlers demonstrate a high degree of reliability in their delivery and are capable of making the small adjustments that are necessary for the variety of shots being played. For recreational curlers, however, the results were less consistent. Some recreational curlers have the ability to deliver the rock reliably, but others do not. In particular, it was the three correlations involving the average speed at release which resulted in the non-significant r values among the recreational curlers. This suggests that curlers of this ability level may have difficulty delivering and releasing the rock consistently with the correct speed and adjusting to various shots. It is important to note, however, that the correlations between the time from the near hogline to the far hogline and the rock displacement were statistically significant for all participants in both groups. This time interval may be the most effective for estimating the total rock displacement for all curlers.

CONCLUSION: The results of this study indicate that the various timing methods to estimate the total displacement of the curling rock are appropriate for competitive curlers, but may not provide accurate estimates for all recreational curlers. It is important for curlers of all levels to develop a reliable delivery in order to be successful.

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