



A Single-Center Review of Spring Assisted Cranioplasty for Sagittal Craniosynostosis and a Critical Analysis of Spring Selection

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Background

- Spring-Assisted Cranioplasty (SAC) is routinely performed to treat scaphocephaly in sagittal craniosynostosis
- Surgeons have control over several modifiable parameters for each patient that are hypothesized to impact outcomes
- Modifiable parameters in SAC:
 - Number of springs implanted
 - Spring force
 - Max spring excursion width
 - Age at surgery
- This study examined the relationship between SAC parameters and postoperative head shape outcomes using cephalic index (CI)

Methods

- Retrospective cohort study
- Inclusion criteria:
 - Patients with sagittal craniosynostosis who underwent SAC from 2014-2021
 - SAC performed by single surgeon (senior author)
 - SAC performed at single center
- Excluded:
 - Patients with multi-suture involvement
- Collected clinical and radiographic data, including CI pre and post operatively for each patient
- Summarized pre-, peri- and postoperative courses from data

Results

Figure 1: Association between preoperative and postoperative CI, $p < 0.001$, $R^2 = 0.33$

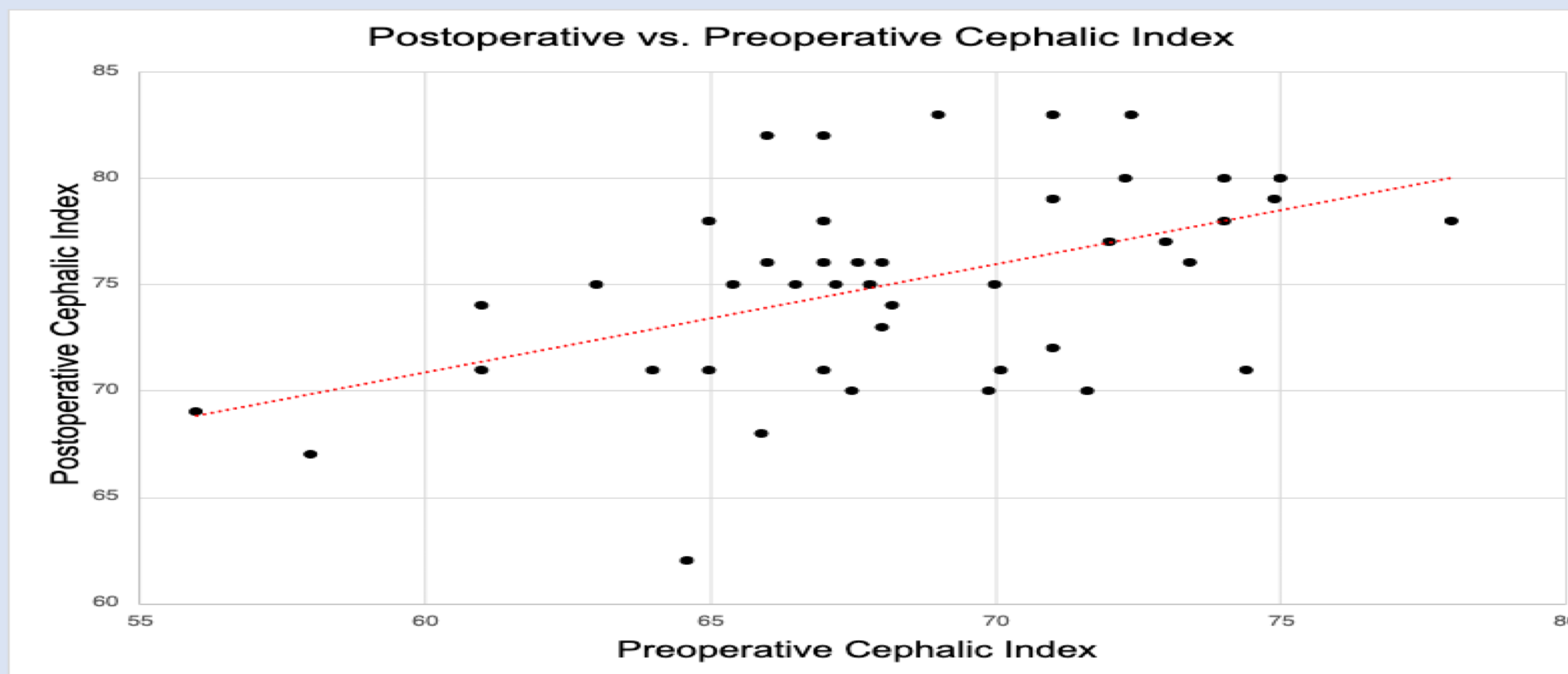
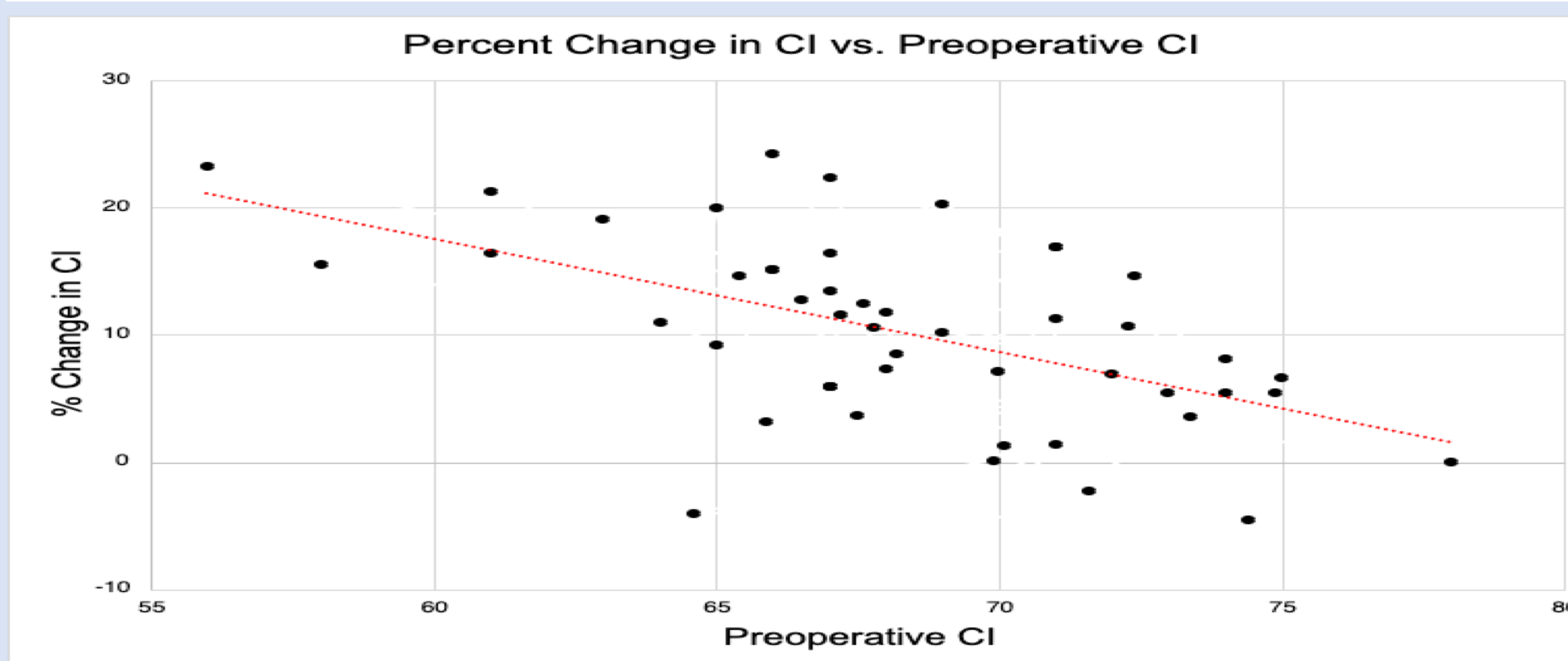


Figure 2: Association between preoperative CI and % change in CI, $p < 0.001$, $R^2 = 0.30$



Statistical Associations

Table 3: Linear Associations Defining Spring Selection and Outcomes

Dependent Variable	Independent Variable	P-value	R2
% Change in CI	Age at surgery	0.53	0.009
% Change in CI	Average spring force	0.69	0.004
% Change in CI	Aggregate spring force	0.29	0.03
% Change in CI	Spring excursion	0.88	0.002
% Change in CI	Number of springs	0.30	0.03
% Change in CI	Duration of spring implant	0.23	0.03
% Change in CI	Preoperative CI	<0.001*	0.30*
Postoperative CI	Preoperative CI	<0.001*	0.33*
Average spring force	Preoperative CI	0.51	0.007
Average spring excursion	Preoperative CI	0.98	<0.001

* Indicates statistical significance at alpha=0.05 and a moderate linear relationship

Conclusions

- Greater spring excursions are chosen for more scaphocephalic patients
- Modifiable parameters including number of springs implanted, spring force, spring excursion or age at surgery did not affect change in CI (pre- to post-op)
- Patients with more severe scaphocephaly were corrected more significantly, but remained more scaphocephalic postoperatively
- Therefore, spring selection for SAC can potentially be optimized without significant consideration for desired change in CI