Change of Craniofacial Deformity after Sternocleidomastoid Muscle Release in Congenital Muscular Torticollis Patients

Joon Kyu Lee¹; Tae-Joon Cho¹; Hyuk-Ju Moon¹; Moon Seok Park²; Won Joon Yoo¹; Chin Youb Chung²; In Ho Choi¹

¹Division of Pediatric Orthopaedics, Seoul National University Children’s Hospital
²Department of Orthopaedic Surgery, Seoul National University Bundang Hospital

2011 Annual Meeting of KPOS, Seoul, Korea
Introduction

Congenital Muscular Torticollis

- Fibromatous contracture of SCM muscle
- Head tilted to the affected side
- Face rotated to the contralateral side
Congenital Muscular Torticollis

- Fibromatous contracture of SCM muscle
- Head tilted to the affected side
- Face rotated to the contralateral side
- Limitation of motion
Congenital Muscular Torticollis

- Fibromatous contracture of SCM muscle
- Head tilted to the affected side
- Face rotated to the contralateral side
- Limitation of motion
- Craniofacial bone deformity
Outcome Evaluation After Treatment

• Improvement of neck ROM
• Neutralization of head position
• Cosmesis
• Release of SCM muscle contracture
• Subjective satisfaction
• Improvement of craniofacial deformity
  – Subjective grading system
  – Quantitative method: rarely used, no comparison
Purpose

• To quantitatively evaluate changes in craniofacial bone deformity after surgical release of SCM contracture

• To assess age factor in postoperative change of craniofacial bone deformity
Materials and Methods

• **Inclusion criteria**
  - Unilateral congenital muscular torticollis
  - Surgical release of SCM muscle contracture
  - Cephalometric evalutaion
  - Less than 15 years-old at surgery
  - Postoperative follow-up more than 12 months
  - Postop residual $\Sigma$ LOM $\leq 10^\circ$
Subjects of study

- 80 patients
- Operated from March, 2003 to June, 2009
- Mean age at surgery: 5.7 yrs (18 mo to 15 yr)
- Male / Female = 53 / 27
- Rt / Lt = 49/31
- Bipolar / Unipolar = 70/10
- Mean F/U: 22.4mo (12 – 52 mo)
- Mean preop. $\Sigma LOM = 56.0^\circ$ (15$^\circ$ – 120$^\circ$)
Protocol for Surgical Timing

- < 18mo : PT, no surgery
- 18 ~ 48mo : The more severe the deformity, the earlier was the surgery performed. No delay over 48mo of age
- Presented after 48mo: Surgery ASAP
Cephalometry

- Posteroanterior projection of skull plain radiography in a standardized position

- Preoperative
- Postop 1 year
- Postop 2 years
- Standardized position
  - Frankfurt plane parallel to the ground
- Standardized position
  - Frankfurt plane parallel to the ground
  - Line btw auditory meatus parallel to the ground
- **Standardized position**
  - Frankfurt plane parallel to the ground
  - Line btw auditory meatus parallel to the ground
  - Line btw auditory meatus parallel to the film
Craniofacial Curvature

Skull Base Tilting Angle (SBTA)  Craniofacial Tilting Angle (CTA)
Craniofacial Asymmetry

Transverse Calvarial Asymmetry (TCA)

Transverse Skull Base Asymmetry (TSBA)

Mastoid Process Length Ratio (MPLR)
Analysis 1: Preop vs. Final F/U

Angle (°) $p < 0.001$ $p < 0.001$

Pre op. Final F/U

paired t-test
Analysis 1: Preop vs. Final F/U

Percentage (\%)  

$ p < 0.001 \quad p < 0.001 \quad p < 0.001$

TCA  
TSBA  
MPLR

paired $t$-test
## Analyses 2 & 3: Dichotomized by age

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (&lt; 5yrs)</th>
<th>Group 2 (&gt;= 5 yrs)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>41</td>
<td>39</td>
<td>-</td>
</tr>
<tr>
<td>Age at surgery (yrs)</td>
<td>2.8 (1.5 – 4)</td>
<td>8.7 (5 – 14)</td>
<td>-</td>
</tr>
<tr>
<td>Preop neck ΣLOM</td>
<td>65.3° (20° - 120°)</td>
<td>46.2° (15° - 100°)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Male/Female</td>
<td>24 / 17</td>
<td>29 / 10</td>
<td>.135</td>
</tr>
<tr>
<td>Right/Left</td>
<td>24 / 17</td>
<td>25 / 14</td>
<td>.610</td>
</tr>
<tr>
<td>Bipolar/Unipolar</td>
<td>34 / 7</td>
<td>36 / 3</td>
<td>.313</td>
</tr>
<tr>
<td>Follow-up (mo)</td>
<td>22.7 (12 – 43)</td>
<td>22.5 (12 – 52)</td>
<td>.466</td>
</tr>
</tbody>
</table>
Analysis 2: Preop. Deformity

- **SBTA**: p = 0.634
- **CFTA**: p = 0.156
- **TCA**: p = 0.018
- **TSBA**: p = 0.018
- **MPLR**: p = 0.001

**ANCOVA**
Analysis 3: Postop. Deformity

$p = 0.626$

$p = 0.497$

$p = 0.318$

$p = 0.169$

$p < 0.001$

paired $t$-test

Group 1

Group 2

SBTA

CFTA

TCA

TSBA

MPLR
Analysis 3: Postop. Changes

**Group 1** vs **Group 2**

- **SBTA**: $p = 0.978$
- **CFTA**: $p = 0.517$
- **TCA**: $p = 0.049$
- **TSBA**: $p = 0.021$
- **MPLR**: $p = 0.462$

*paired t-test*
Analysis 4: Changes in 1\textsuperscript{st} vs. 2\textsuperscript{nd} year

- Cephalometry in 1 and 2 years
- n = 42
- Age (yr) : 5.9 yrs (1.5 ~ 15)
- Preop $\Sigma$LOM: avg. 55.2° (25° ~ 120°)
- Male / Female = 30 / 12
- Rt / Lt = 26 / 16
- Bipolar / Unipolar = 39 / 3
Analysis 4: Changes in 1\textsuperscript{st} vs. 2\textsuperscript{nd} year

\begin{align*}
\text{SBTA} & : p < 0.001 \\
\text{CFTA} & : p < 0.001 \\
\text{TCA} & : p < 0.001 \\
\text{TSBA} & : p < 0.001 \\
\text{MPLR} & : p = 0.891
\end{align*}

Wilcoxon signed-rank test
Discussion

How to Assess Craniofacial Deformity?

• Mostly subjective visual assessment
• Downward displacement of eye, plagiocephal, flattening of malar eminence, difference in size & position of ears (Canale et al, 1982; Ippolito et al, 1985)
• Difference in size of malar eminence, flattening of occiput, deviation of eye and nose to affected side, prominence of mastoid process (Shim et al, 2008)
Quantitative measurement of craniofacial deformity

• 3D-CT of the skull (Yu, 2004; Chung et al, KPOS)

• Cephalometry
  - Ferguson (1993): no parameter, n = 4, age > 20 yrs
  - Hollier (2000): “reduced facial height”
  - Arslan (2002): postop change, n = 12, age > 6yrs
  - 김휘택(2003): preop. only
  - 이동연(2007): preop. only, defined parameters, interobserver/intraobserver reliability
This study revealed....

• The skull is curved to the affected side.
• Calvarium and skull base are wider on the affected side, and the mastoid is longer on the affected side.
• CF deformities improve, but not completely.
• More improvement occurs in the 1st year than 2nd year, except mastoid length difference.
Limitations of this study

- Not an RCT
- Included operated patients only
- No reference data of the cephalometric parameters
- Short follow-up

Strength of this study

- Quantitative evaluation postoperative change
- 80 patients/ Age range 1 ~ 15 years
- Parameters with substantial intra-inter observer reliability
Younger pts group (< 5yrs)
  - more severe preop. CF asymmetry
  - more postop improvement

• Does CF asymmetry improve spontaneously with age?
• Does SCM release improve it more effectively in younger pts?
Optimal timing of Surgery

- Operation before one year of age not recommended
- Between age 1 and 4 years (Ling and Low, 1972)
- Up to 6 years (Canale et al, 1982, Ippolito et al, 1985)
- Older than 8 years (Shim et al, 2004)
- Up to 12 years (Coventry et al, 1959, Lee et al, 1986)
Conclusion

- Postsurgical improvement of craniofacial bone deformity was quantitatively verified.
- Residual CF curvature may contribute appearance of residual head tilting.
- There is no reason to delay SCM release later than 5 (or 4) years of age.
Thank you for your attention!

2011.6.4.
Ukai 마을, Gifu, Japan