Marginal mandibular branch as a surgical risk factor: anatomy and biomechanics

Ex-vivo, anatomical study

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The study was undertaken following approval from the ethical committee (Semmelweis University, Regional and Institutional Committee of Science and Research Ethics; TUKEB No. 127/2014) and in accordance with the declaration of Helsinki, using the National Research, Development and Innovation Office – NKFIH, OTKA K-116189 grant.
The aim of the presentation:

I. To clinically and culturally illustrate the importance of the mandibular branch of the facial nerve

II. To present the usual anatomy

III. To demonstrate our anatomical findings in a Hungarian population related to biomechanical forces
General anatomy-portsions

- BRAIN
- INTRACRANIAL  23-24 mm
- MEATAL        8-10 mm
- LABYRINTHIC  3-5 mm
- TYMPANIC      8-11 mm
- MASTOID       10-14 mm
- EXTRATEMPORAL Δ
Basilary artery

Pons
Pleomorph adenoma

Conley

MMB
Facial artery

MMB

Submandibular gland

Lingual artery

Carotids

Zygoma

Mandibula

XII.
Davis et al., /Miehlke, Katz/

I. No anastomosis between TF & CF divisions

II. TF anastomosis only

III. Single anastomosis between TF & CF divisions

IV. Combination of type II. & III.

V. Double anastomosis between TF & CF divisions

VI. Complex, multiple anastomosis

• Mean number of the branches at the anterior margin of the parotid gland: 7,7 +/- 1,05

• Mean number of the branches distally: 13,8 +/- 1,81

• TEMPORAL: 2,8 +/- 1,81
• ZYGOMATIC: 4,4 +/-1,34
• BUCCAL: 3,2 +/- 0,78
• MARGINAL: 2,3 +/- 0,48
MMB Retromandibular vein

Buccal branch

Anastomosis

MMB

Retromandibular vein
Lymph node

mandibular gland

XII.
MECHANISM of TRAUMA

- MICROTRAUMA
- CRUSH
- TRACTION
- TRANSSECTION
- ISCHAEMIA
- EDEMA
- TERMAL
- ELECTRICAL
- CICATRISATION
SUNDERLAND

• I. NEUROPRAXIA

• II. AXONOTMESIS /axons, Wallerian degeneration/

• III. NEUROTOMESIS /endoneural tubules/

• IV. PERINEURAL TEAR

• V. TOTAL TEAR

/I.-III. by compression, IV.-V. no total recovery without surgery/

The House-Brackmann grading system

I. Normal facial function in all areas

II. Slight weakness on close inspection

III. Obvious, not disfiguring difference, no functional deficit

IV. Obvious weakness +/- disfiguring asymmetry

V. Only barely perceptible motion

VI. No motion

IATROGENY 5.6-7%

- Oral & maxillofacial surgery 40%
- Parotidectomy 25%
- Otosurgery 17%
- Cosmetic surgery 11%
- Other 7%


RESULTS

• 31 corpses, 55 hemifaces

• 13 Male (11 included) 18 Female (all included)

• L:9 R:10 (altogether 19 HF) L:18 R:18 (altogether 36 HF)

• 58-94y, m: 76,69y 60-90y, m: 73,73y

• Non dissected: haemorrhage, autolysis, time not allowed
<table>
<thead>
<tr>
<th>No.</th>
<th>% all hemifaces</th>
<th>% all MMB branches</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>74.54</td>
<td>58,57</td>
</tr>
<tr>
<td>2</td>
<td>23.63</td>
<td>37.14</td>
</tr>
<tr>
<td>3</td>
<td>1.81</td>
<td>4.28</td>
</tr>
<tr>
<td>No.</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>-----</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>M/F (19/36) (of included hemifaces)</td>
<td>L/R (38/32 no. branches) (of all br. Of the given side)</td>
</tr>
<tr>
<td>1</td>
<td>41</td>
<td>73.68/75</td>
</tr>
<tr>
<td>2</td>
<td>13</td>
<td>26.31/22.22</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0/2.77</td>
</tr>
<tr>
<td></td>
<td>No.</td>
<td>% /70</td>
</tr>
<tr>
<td>----------------</td>
<td>-----</td>
<td>---------</td>
</tr>
<tr>
<td>Premandibular</td>
<td>45</td>
<td>64,28</td>
</tr>
<tr>
<td>Mandibular rim</td>
<td>8</td>
<td>11,42</td>
</tr>
<tr>
<td>Mandibula</td>
<td>17</td>
<td>24,28</td>
</tr>
</tbody>
</table>

(of included branches)
### VERTICAL ORIGIN

<table>
<thead>
<tr>
<th>Region</th>
<th>No.</th>
<th>%</th>
<th>%M/F</th>
<th>%L/R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandibula</td>
<td>55</td>
<td>78,57</td>
<td>66,66/84,78</td>
<td>78,94/78,12</td>
</tr>
<tr>
<td>Inferior rim</td>
<td>1</td>
<td>1,42</td>
<td>0/2,17</td>
<td>0/3,12</td>
</tr>
<tr>
<td>Inframandibular</td>
<td>14</td>
<td>20</td>
<td>33,33/13,04</td>
<td>21,05/18,75</td>
</tr>
<tr>
<td>Branch</td>
<td>No.</td>
<td>%</td>
<td>%M/F</td>
<td>%L/R</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----</td>
<td>------</td>
<td>------</td>
<td>--------</td>
</tr>
<tr>
<td>Mandibula</td>
<td>18</td>
<td>25.71</td>
<td>25/26.08</td>
<td>26.31/25</td>
</tr>
<tr>
<td>Inferior rim</td>
<td>6</td>
<td>8.57</td>
<td>8.33/8.69</td>
<td>7.89/9.37</td>
</tr>
<tr>
<td>Submandibular</td>
<td>46</td>
<td>65.71</td>
<td>66.66/65.21</td>
<td>65.78/65.62</td>
</tr>
</tbody>
</table>
Course μ ↑ in males
65.71%

Vertical orientation
Vo Er Ri Tg 78.57%
Il i Cn A j

Horizontal origin
64.28%
8.57% of all specimens

83.33% : 16.66% = female : male

66.66% to buccal area

16.66% to cervical area

16.66% from buccal branch
ANASTOMOSIS

14.28% of all MMB (loop included)
8.57% of all MMB (without loop)

60% female
80% left

<table>
<thead>
<tr>
<th>Type</th>
<th>No.</th>
<th>%/70</th>
<th>M/F</th>
<th>L/R</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-M</td>
<td>2</td>
<td>2.85</td>
<td>female</td>
<td>left</td>
</tr>
<tr>
<td>M-C</td>
<td>1</td>
<td>1.42</td>
<td>male</td>
<td>left</td>
</tr>
<tr>
<td>M-B</td>
<td>4</td>
<td>5.71</td>
<td>50-50%</td>
<td>left</td>
</tr>
<tr>
<td>2x M-B</td>
<td>1</td>
<td>1.42</td>
<td>female</td>
<td>left</td>
</tr>
<tr>
<td>M loop</td>
<td>4</td>
<td>5.71</td>
<td>1/3</td>
<td>2/2</td>
</tr>
</tbody>
</table>
CONCLUSIONS

• 1 branch is present in the majority of cases, /1,27 MMB/hemiface in this study/

• Double or triple branching is more frequent on the left

• Usually originates behind the mandibula, over the level of the rim

• Inframandibular origin is more frequent in males

• Submandibular course in about 2/3 of the cases

• Collaterals & anastomosis may occur, especially in females

• The anatomy of the MMB & neighbouring structures is unstable

• Other pathologies may be associated
Thank you for the attention!
• Dissective, ex-vivo study

• 2014-

• Fresh human cadavers

• VII.

• Marginal mandibular branch pathway, branching, collaterals, anastomosing
MMB

- Lowest number of distal branches
- Length
- „Terminal branch”
- Most often dissected branch
- Ease of preparation
- Unpredictable answer to trauma
- Risk in case of head & neck, esthetic surgery
• Identity, gender, age, emotional state –processed in 200 ms /Beck/

• Universal, culturally independent emotions /Darwin/

• Happiness, anger, disgust, fear, sadness, surprise /Ekman/

• Communication

• Eating-drinking

• Palsy, rehabilitation, transplantation
- Symptom Checklist 90
- State-Trait Anxiety Inventory
- Liebowitz Anxiety Scale
- Social Interaction Anxiety Scale
- Social Phobia Scale
- Beck Depression Inventory
- Facial Disability Index
• Second branchial arch, facioacoustic primordium

• 8th week: arborization /chemotropism, contact/

• Angle of the mouth moves: 12th week

• 16th week all neuromuscular junctions

• Myelinisation and final position by the 4th year

• Largest number of communications

• Mentalis, depressor labii inferioris, depressor anguli oris, platysma, risorius –MMB

• Zygomatic /67%/ , canine /31%/ , total /2%/
Styloid process
Hyoid bone
Styloid process
<table>
<thead>
<tr>
<th>Branches</th>
<th>MHF/ FHF</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/26</td>
<td>17/24</td>
</tr>
<tr>
<td>2</td>
<td>1/5</td>
<td>9/15</td>
</tr>
<tr>
<td>3</td>
<td>1/1</td>
<td>1/3</td>
</tr>
<tr>
<td>4</td>
<td>1/1</td>
<td>1/1</td>
</tr>
</tbody>
</table>

HF: hemiface, br.: branch
• Mean number of the branches at the anterior margin of the parotid gland: 7,7 (6.72) +/- 1.05

• Mean number of the branches distally: 13.8 (12.23) +/- 1.81

• TEMPORAL: 2.8 (2.07) +/- 1.81
• ZYGOMATIC: 4.4 (4.05) +/- 1.34
• BUCCAL: 3.2 (4.53) +/- 0.78
• MARGINAL: 2.3 (1.56) +/- 0.48

Our data based on 90 hemifaces.

CONCLUSIONS

- VII. is the most often damaged cranial nerve
- Head&Neck surgery may damage the MMB
- MMB is the most often dissected branch of VII.
- Chances of morbidity are elevated, „length”!
- Morphology is unstable, vigilance needed