

Embouchure Assistive Device

Advisor: Amit Nimunkar

Client: Elon Roti Roti

Team Members:

Vivian Chen

Patrick Cassidy

Andrew LaCroix

Megan Jones

- Background
 - Bell's palsy
 - Synkinesis
 - Clarinet embouchure
- Motivation
- Problem statement
- Design
 - Requirements
 - Alternatives
- Matrix
- Final design
- Future work
- Testing

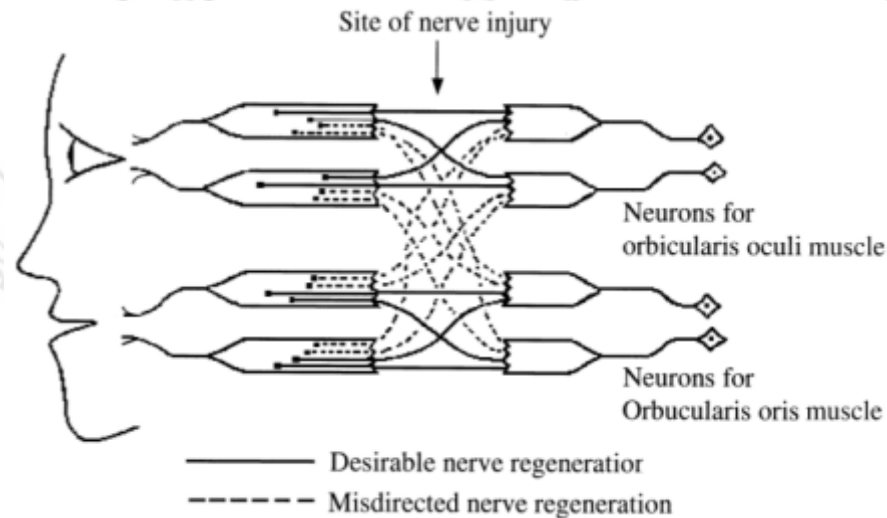


Bell's Palsy

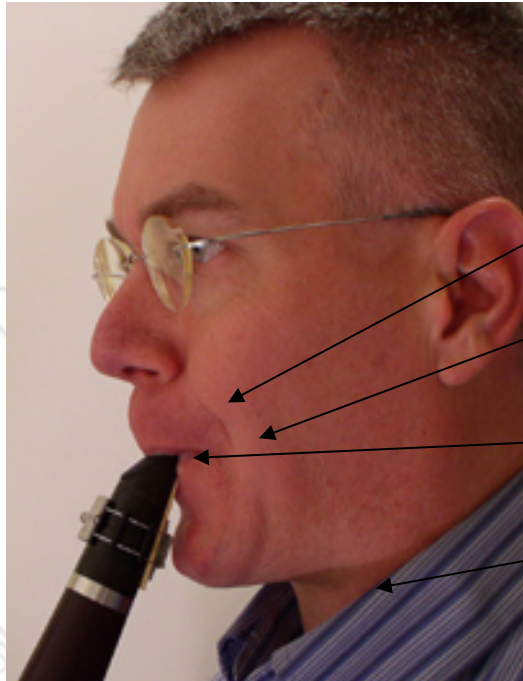
- Bell's palsy: facial paralysis due to dysfunction of cranial nerve VII
 - Cause: nerve inhibition due to inflammatory condition



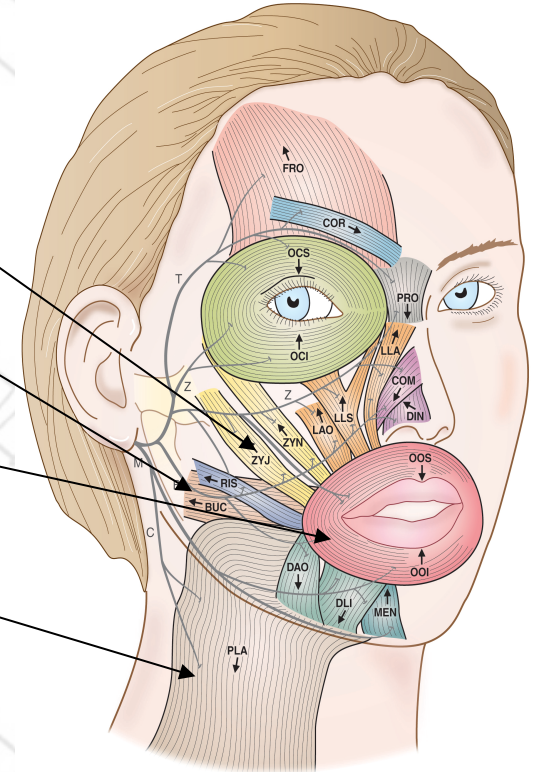
- Synkinesis: abnormal muscle movement during normal movement
 - Cause: misdirection of neurons upon regeneration
 - Most often affects muscles around mouth



Clarinet Embouchure



Zygomaticus
Buccinator
Orbicularis Oris
Platysma

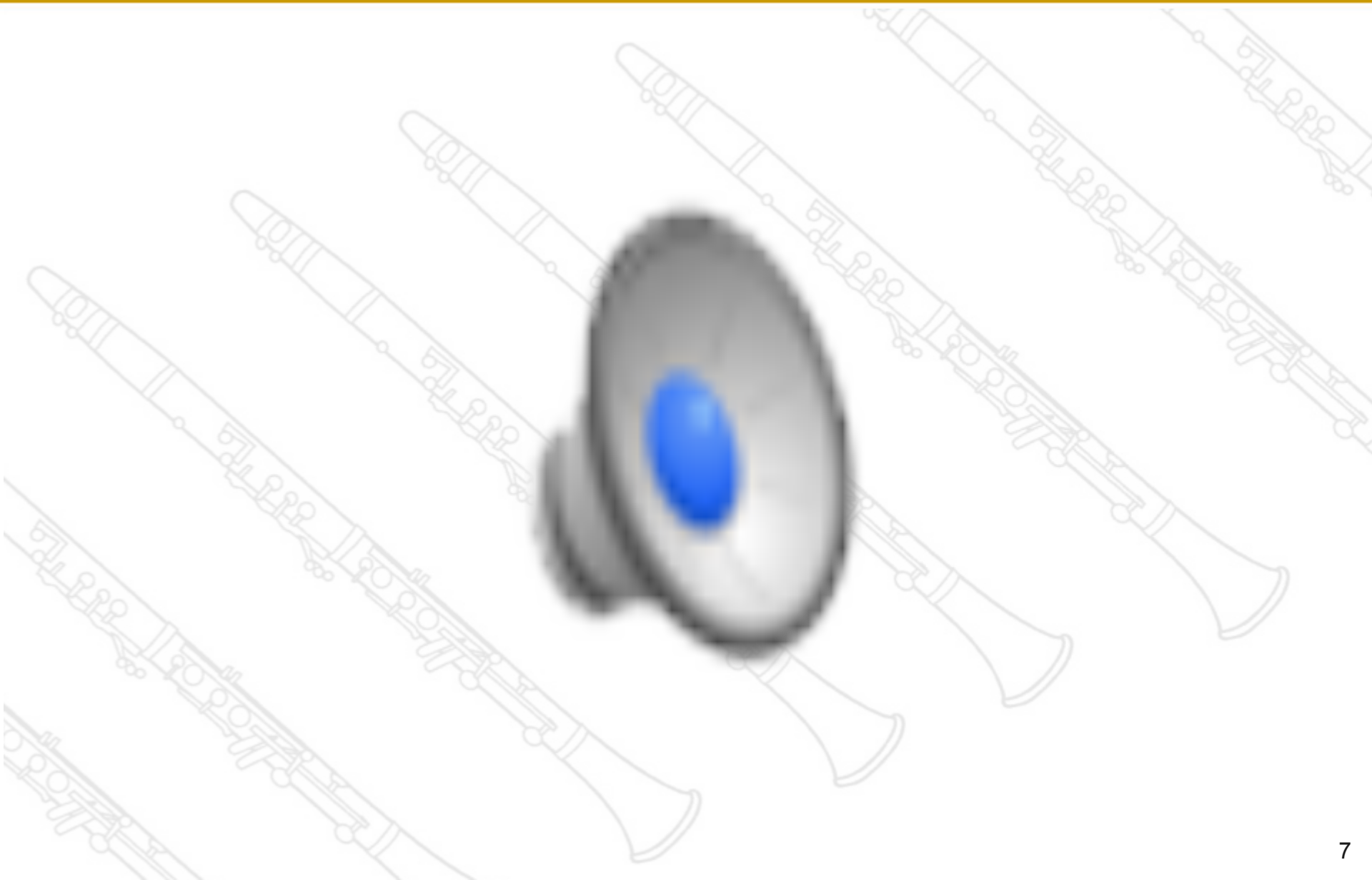


- Due to synkinesis, muscles contract simultaneously

Project Motivation

- Synkinesis prevents engagement of correct muscles when playing clarinet
- Assistive device needed to help maintain pressure on mouthpiece
- Device should also reduce air leakage at corner of mouth

Problem Statement



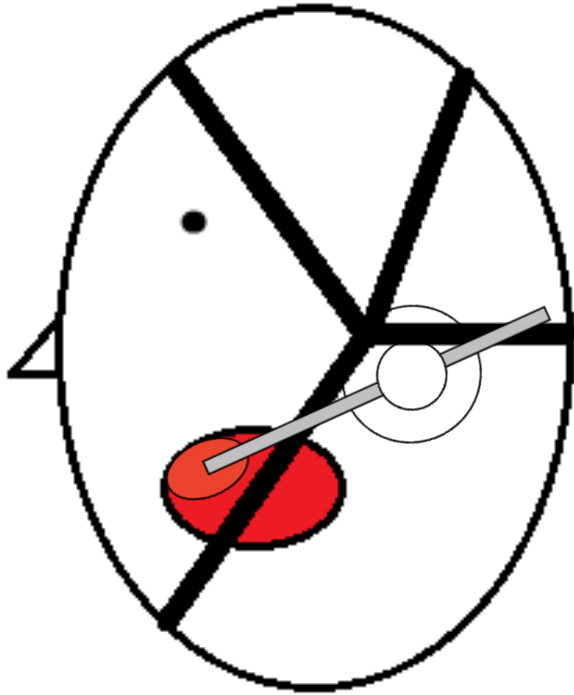
Design Specifications

- Extend quality play time to at least 30 minutes
- Must not restrict playing
- Easy to use/clean
- Low cost
- Must maintain constant pressure
- Lightweight
- Preferably a “head gear”

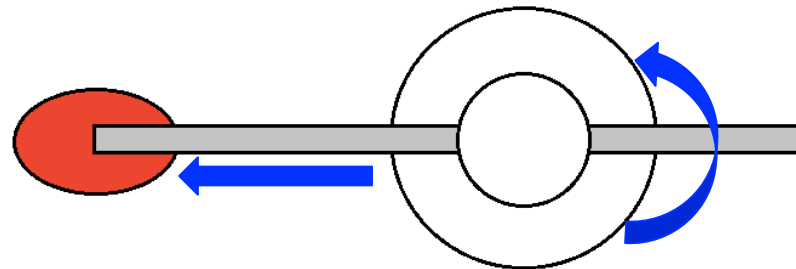
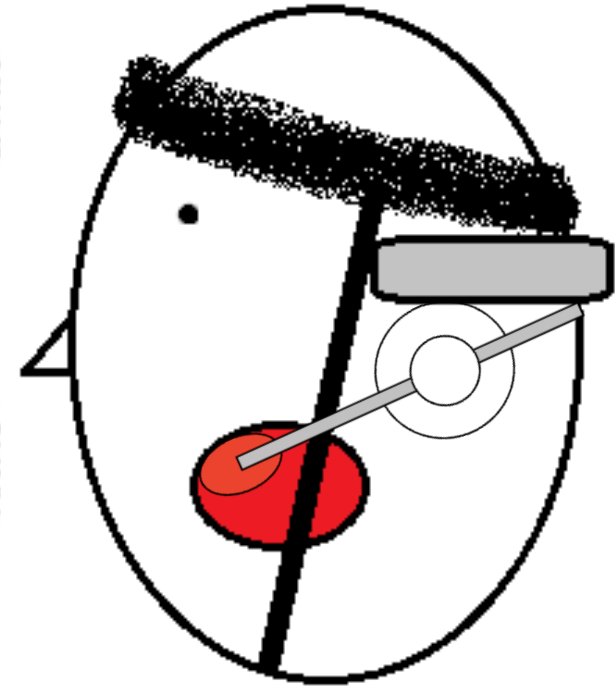


Design 1: Headgear

“Straps”

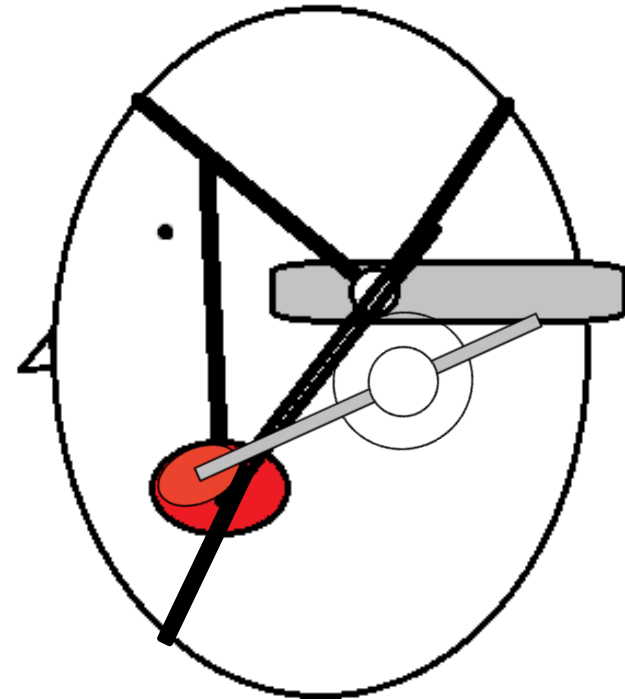


“Headband”

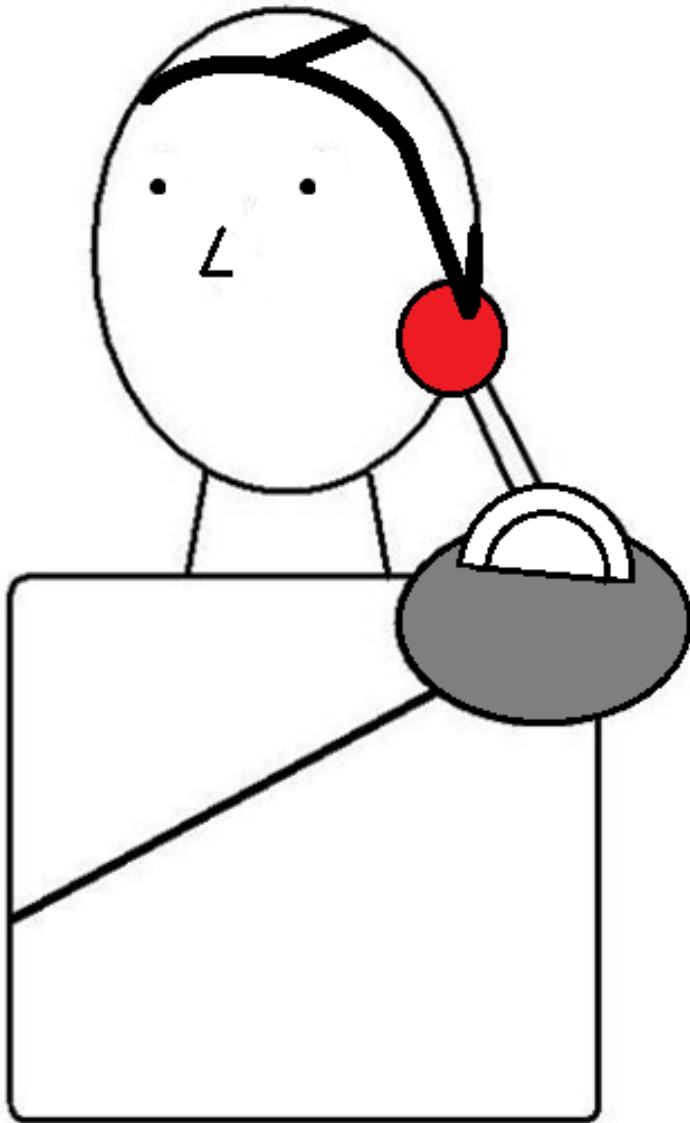


Solution: Combine!

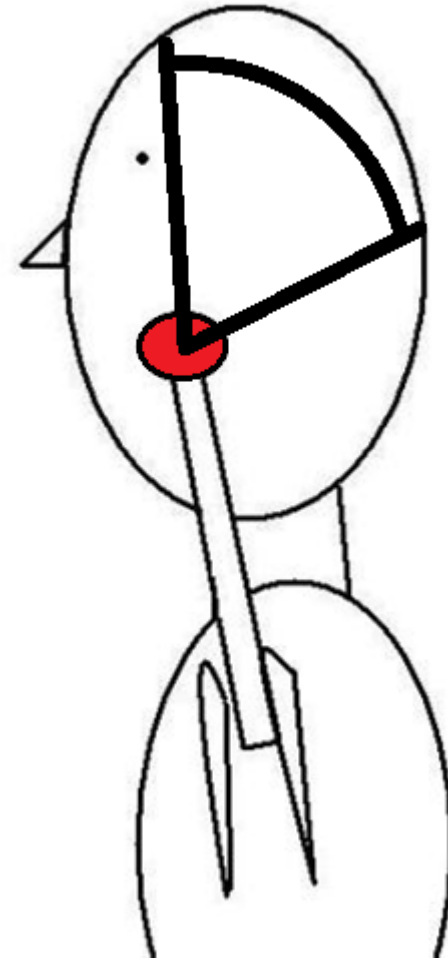
- Contoured metal bar behind head provides countering force for headset
- Allows for all forces: inward, upward, and forward
 - Magnitude an issue
- Weight an issue



Design 2: Shoulder



“Mad Max”



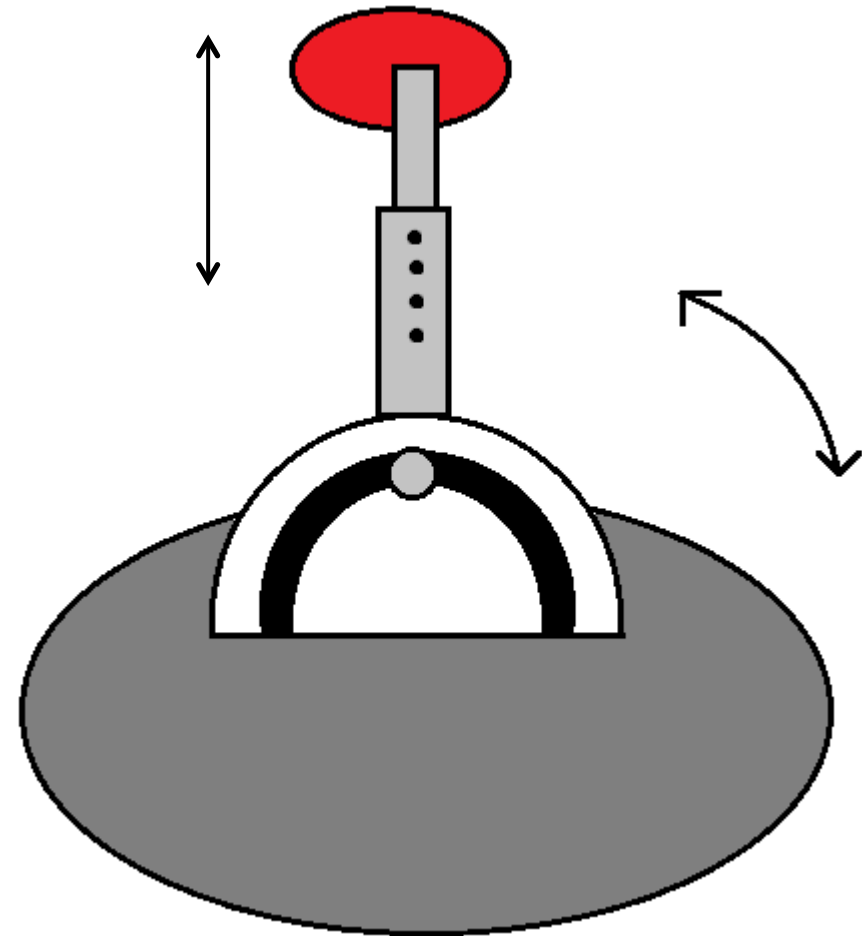
Extreme Close Up

Pros:

- Good upward and inward force
- Head straps secure force applicator
- Allows for client control of direction and magnitude of force

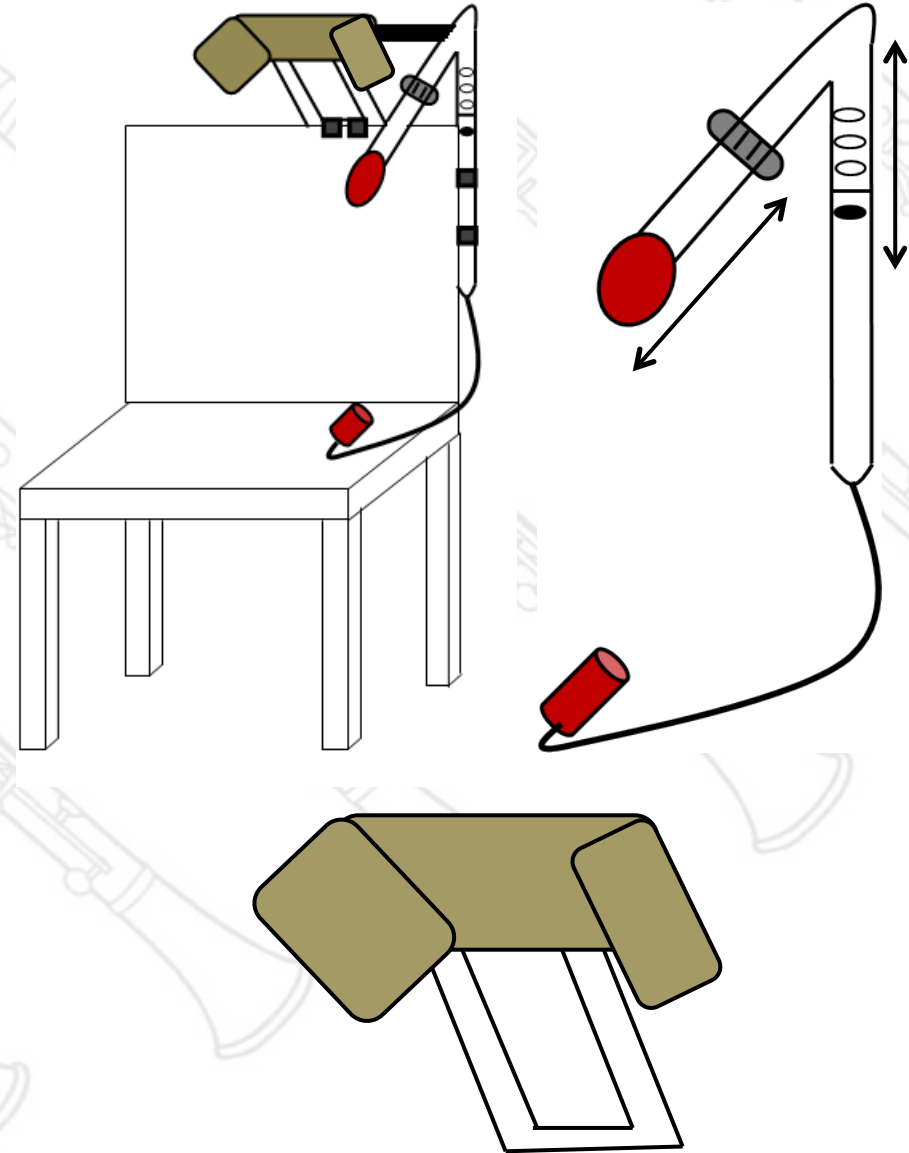
Cons:

- Cumbersome
- May tire out shoulders



Design 3: Chair Attachment

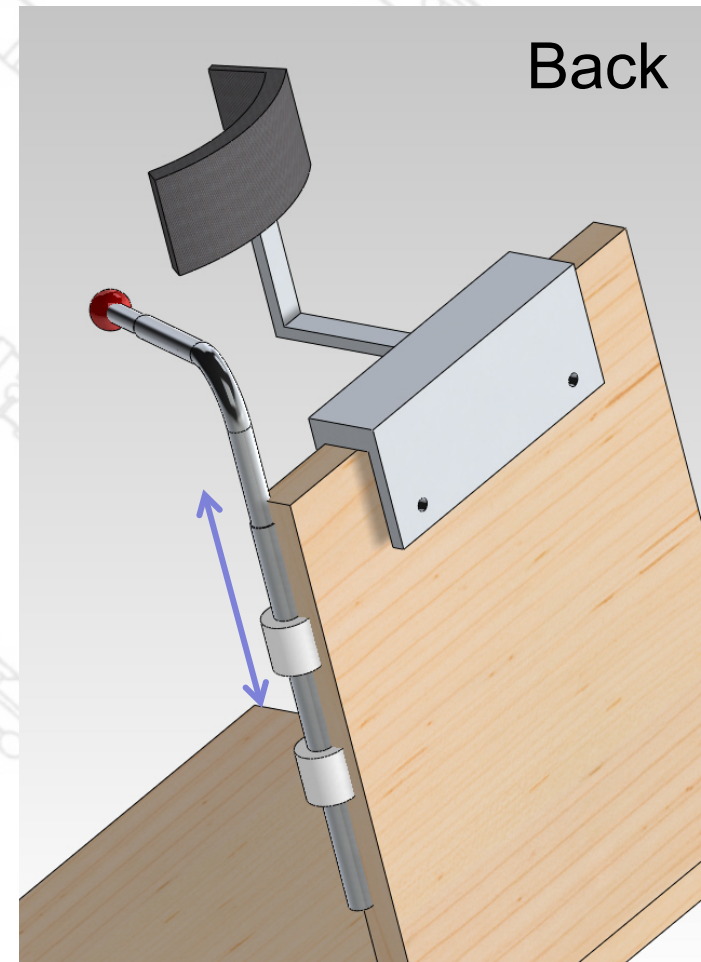
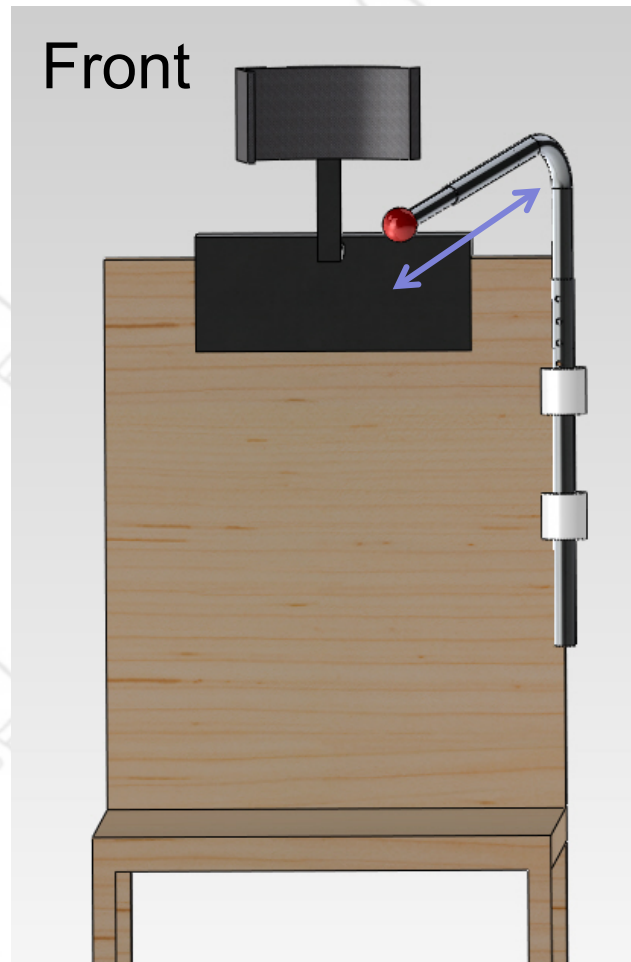
- Two components:
 - 1) Headrest
 - 2) Adjustable side attachment
- Headrest aids in head stabilization
 - Contours to head
- Side attachment applies forward pressure
- Air balloon applies fine pressure



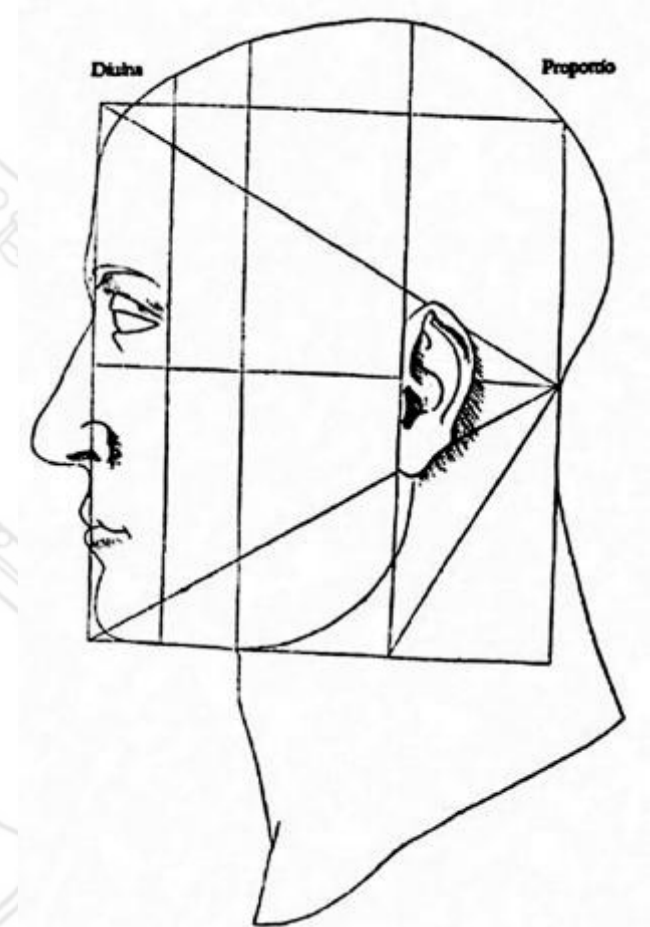
Design Matrix

Weight	Categories	Headgear	Shoulder	Chair
10	Fabrication	3	8	4
10	Cost	7	5	2
20	Ease of Use	10	15	14
20	Client Preference	20	10	15
40	Directionality/Pressure/Force	25	20	35
100		65	58	70

Chair Attachment

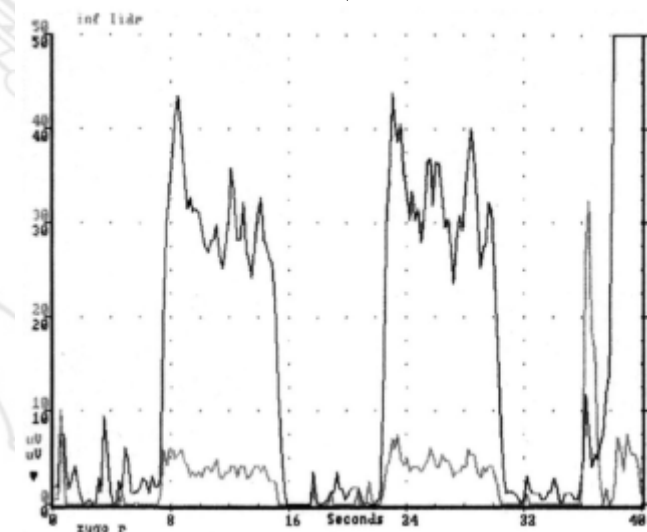
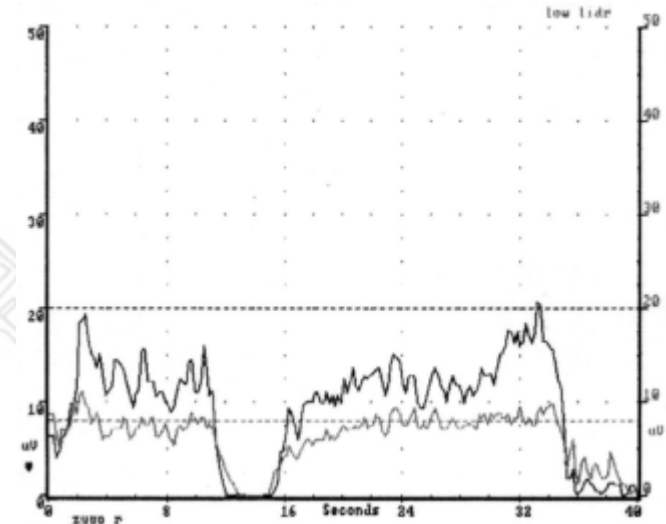


- Measures for dimensions of device
 - Sitting position relative to chair
 - Average chair dimensions
- Materials
 - Investigate different molding systems for headrest
 - Maximize rotational and bending stability
- Fabricate prototype
- Testing



Testing

- Repeatability
- Maximum force possible
 - Supported by headrest
 - Applied by device
- Surface EMG [3]
- User testing:
 - Effectiveness
 - ◆ Tone improvement
 - ◆ Lengthen time able to practice/play
 - Comfort
 - Ease of use/setup



Acknowledgements

- **Advisor:** Amit Nimunkar
- **Client:** Elon Roti Roti
- **Facial rehabilitation specialist:** Jackie Diels
- **Rolfer:** Brooke Tekac

1. Moran, C. J., & Neely, J. G. (1996). Patterns of Facial Nerve Synkinesis. *The Laryngoscope*, 106(12), 1491-1496.
2. Nakamura, K., Toda, N., Sakamaki, K., Kashima, K., & Takeda, N. (2003). Biofeedback Rehabilitation for Prevention of Synkinesis after Facial Palsy. *Otolaryngology -- Head and Neck Surgery*, 128(4), 539-543.
3. VanSwearingen, J. M., & Brach, J. S. (2003). Changes in facial movement and synkinesis with facial neuromuscular reeducation. *Plastic and reconstructive surgery*, 111(7), 2370.
4. http://en.wikipedia.org/wiki/Bell's_palsy
5. <http://www.clarinet-now.com/poor-clarinet-embouchure.html>

Questions

