

3D Printed Embouchure Assistive Device for Woodwind Musicians with Facial Palsy

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Background

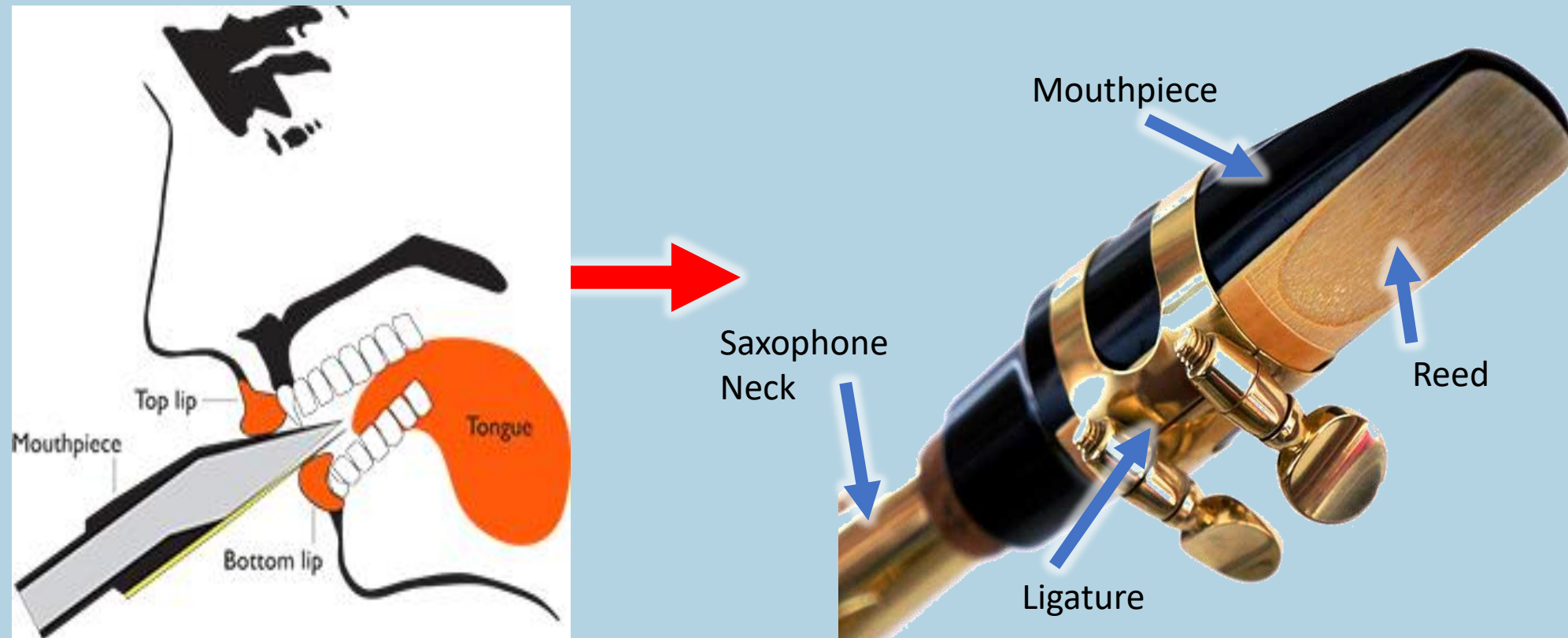


Figure 1: Side view of mouth placement used for saxophone embouchure (left) and mouthpiece anatomy (right).

- **Woodwind musicians** use a complex coordination of their cheek, mouth, teeth and tongue to create a seal with the mouthpiece - called an embouchure - in order to produce sound.
- **Facial Palsy** in woodwind musicians results in the loss of facial muscle function, causing a lack of sound control or the loss of play ability entirely

Goal

Our project focuses on the development and fabrication of an inexpensive 3D-printed assistive device for a tenor saxophone musician with partial facial palsy to assist his facial muscles in creating the necessary embouchure to produce quality sound.

Pressure Measurement

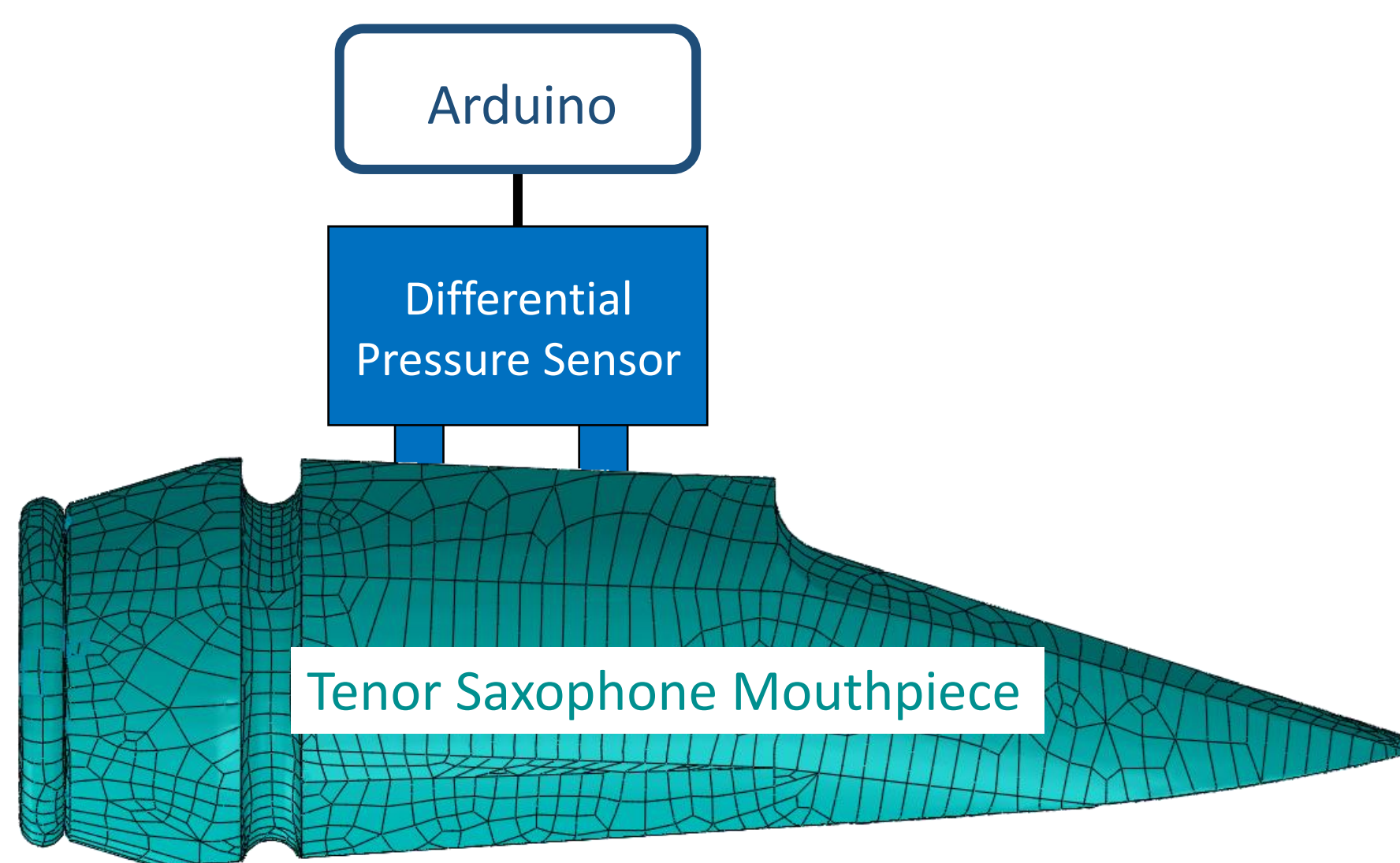
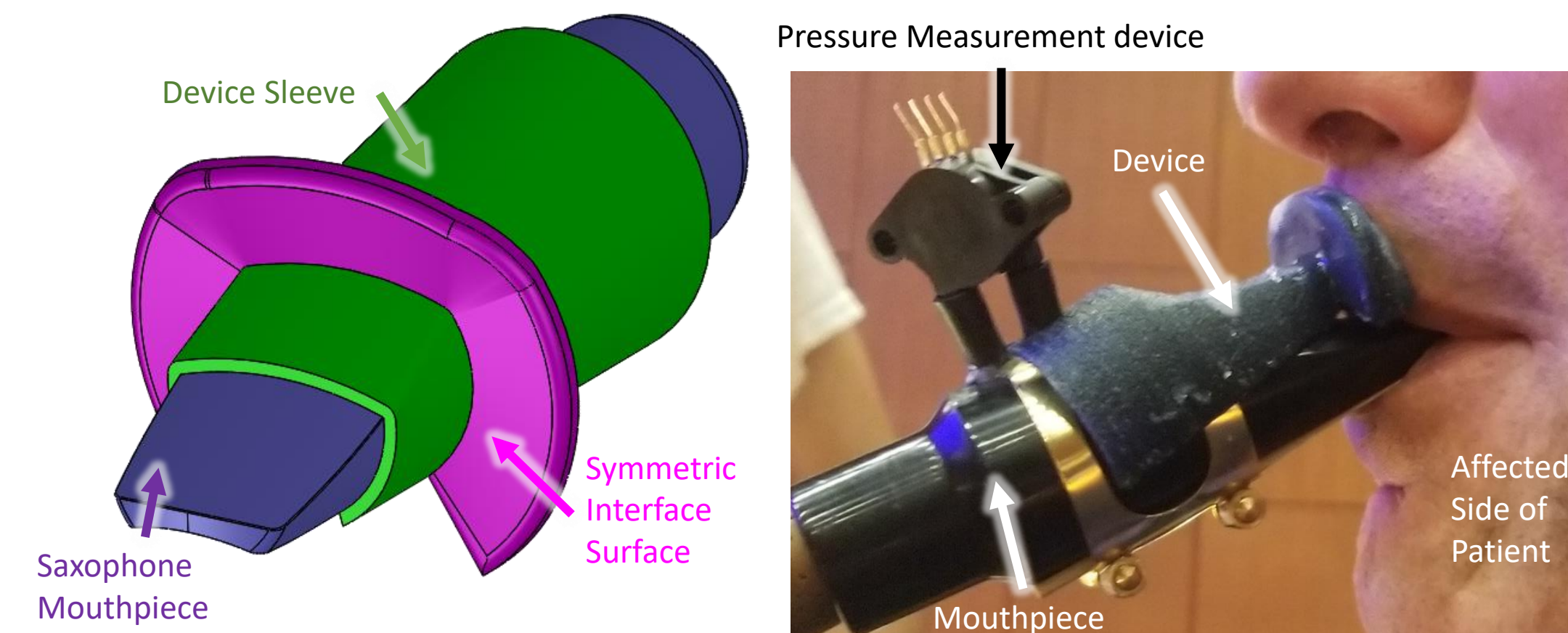


Figure 2: Pressure measurement set up using differential pressure sensor and Arduino

Design Iterations

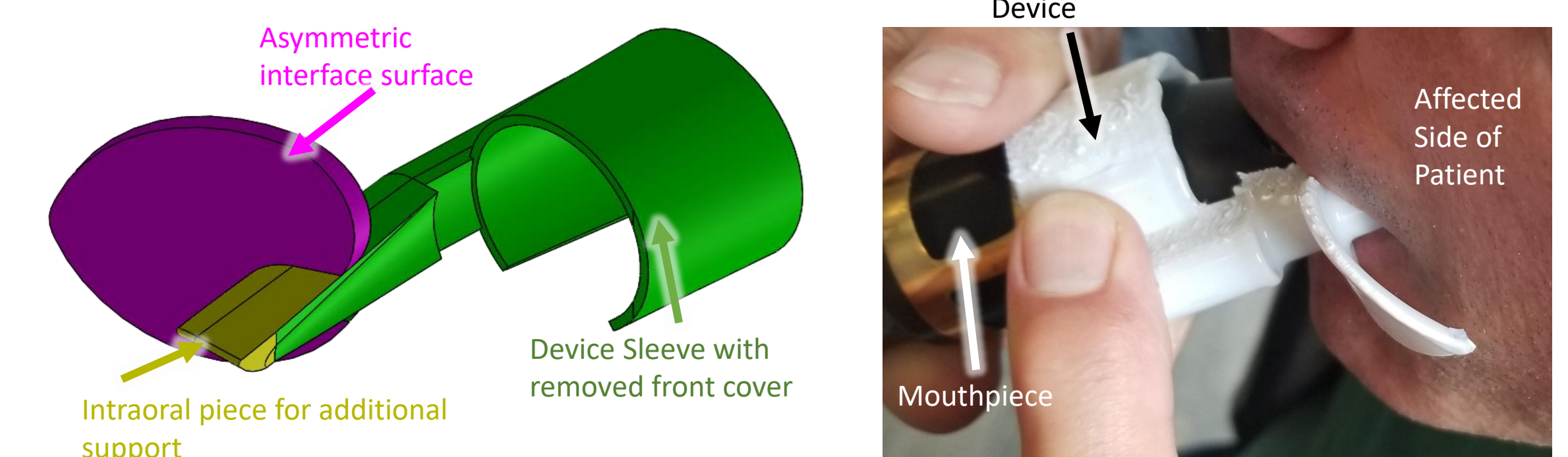
Iteration Phase 1

Initial Design created before first meeting with patient based on reference [1]



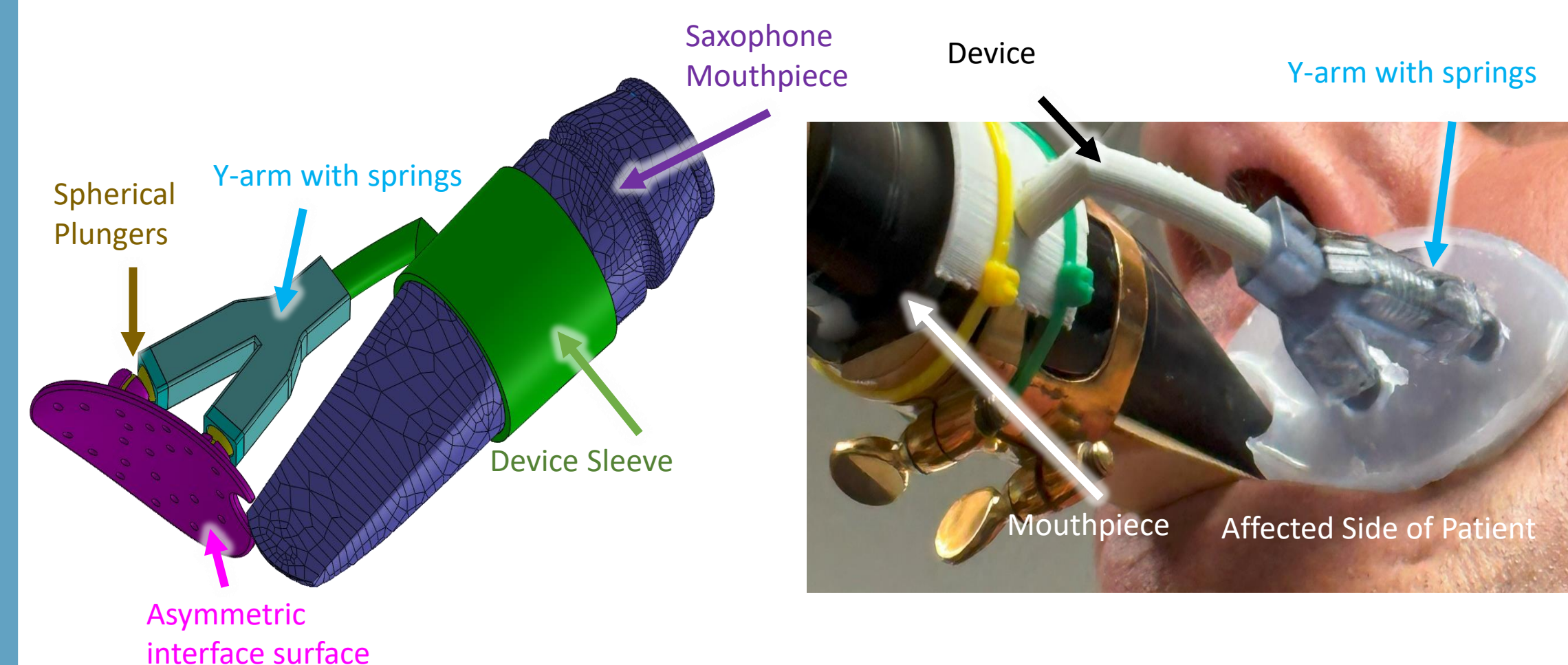
Iteration Phase 5

Updated design based on reference [2]



Iteration Phase 7

Dynamic device without intraoral piece
Designed to adjust to patient's embouchure



Iteration Phase 8: Final Design

Silicone interface with rigid supporting wall



Performance

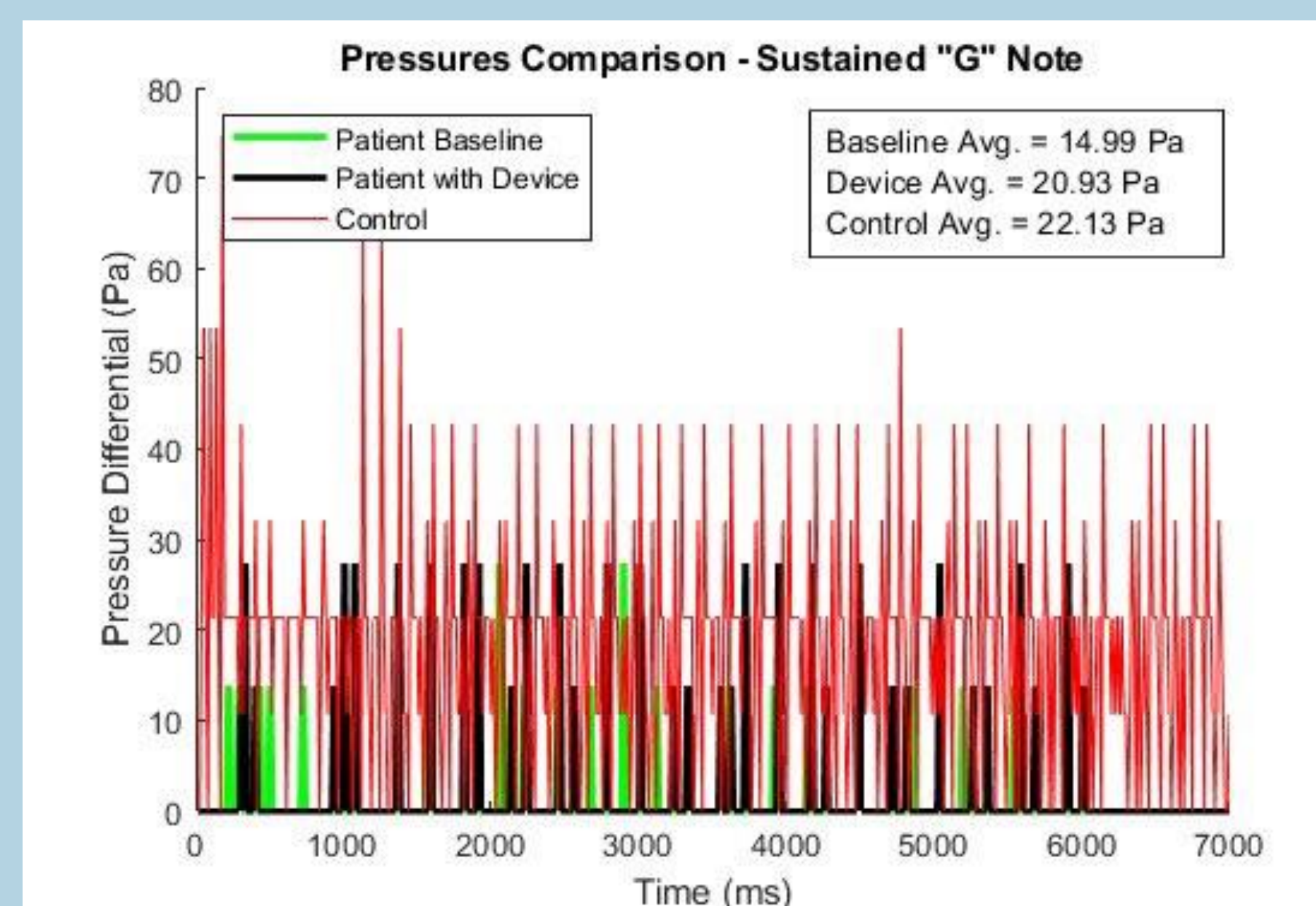


Figure 3: Pressure comparison of patient playing a sustained "G" note with and without a device to a volunteer Saxophonist (control) with full control of facial muscles

Testing Videos!

Patient Without Device:



Patient With Device:



Discussion

Conclusion

- Device creates seal for maximum input airflow
- Improvements in pressure measurements
- Improved sound quality and performance
- Patient is able to play for longer period of time

Future Work

- Current attachment via hose clamp and zip ties– want to change
- More iterations for silicone mold on final design
 - Different shapes/sizes
- Test symmetric design

Acknowledgements

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References

- [1] "Tools for Facial Paralysis and Playing the Saxophone." Saxontheweb.Net, 14 Apr. 2011, www.saxontheweb.net/threads/tools-for-facial-paralysis-and-playing-the-saxophone.157990/. Accessed 17 Mar. 2023.
- [2] Aita-Holmes, Cynthia DMD, et al. "Digital Capture, Design, and Manufacturing of an Extraoral Device for a Clarinet Player with Bell's Palsy." The Journal of Prosthetic Dentistry, vol. 114, no. 2, 2015, <https://doi.org/10.1016/j.prosdent.2015.02.029>. Accessed 6 Mar. 2023.