



Expanding Airways – Approaches in SGS

GROUP 33 - **TAYLOR HUGHES**, BRIAN DALLESASSE, KYLE SACHDEV

Overview

- ▶ Background
- ▶ Current Treatment Strategies
- ▶ Our Proposed Solution
- ▶ Team Responsibilities
- ▶ Conclusion

Background

- ▶ Subglottic Stenosis (SGS) partially or completely obstructs the airway region directly beneath the vocal cords
 - ▶ Cricoid cartilage
 - ▶ Causes
 - ▶ Symptoms
 - ▶ Grading of severity



Grade 1
Stenosis 0-50%



Grade 2
Stenosis 51-70%

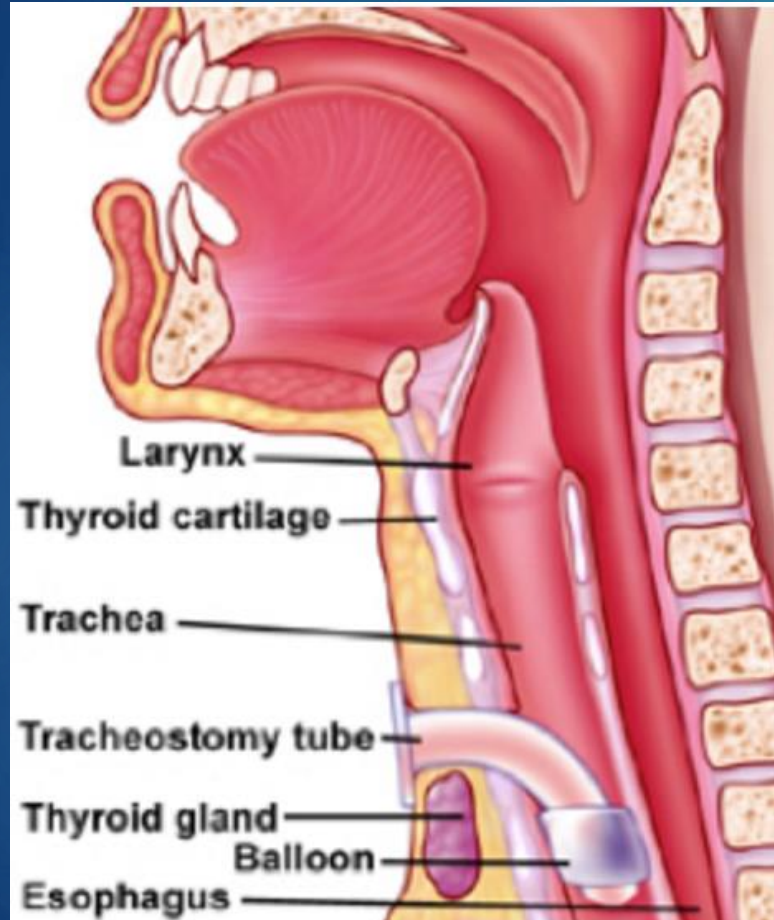


Grade 3
Stenosis 71-99%

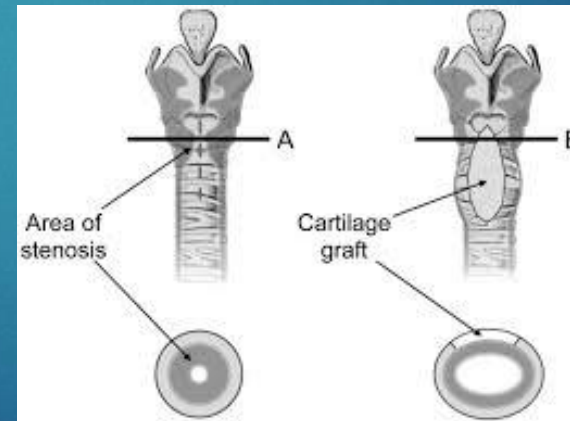


Grade 4
Stenosis 100%

Background

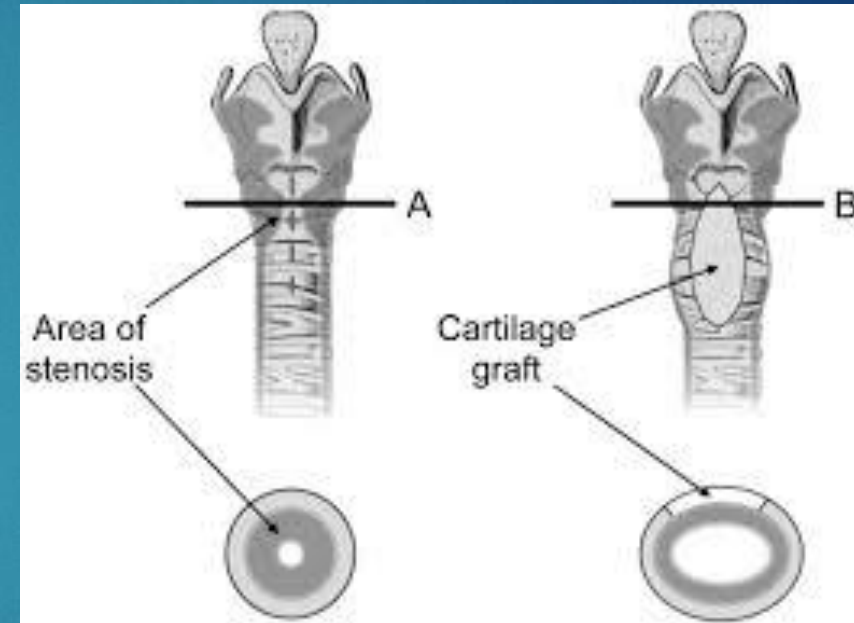


- ▶ Treatment of SGS depends on the grade of the injury
 - ▶ Grades 1 & 2
 - ▶ Grades 3 & 4
 - ▶ Laryngotracheal reconstruction surgery

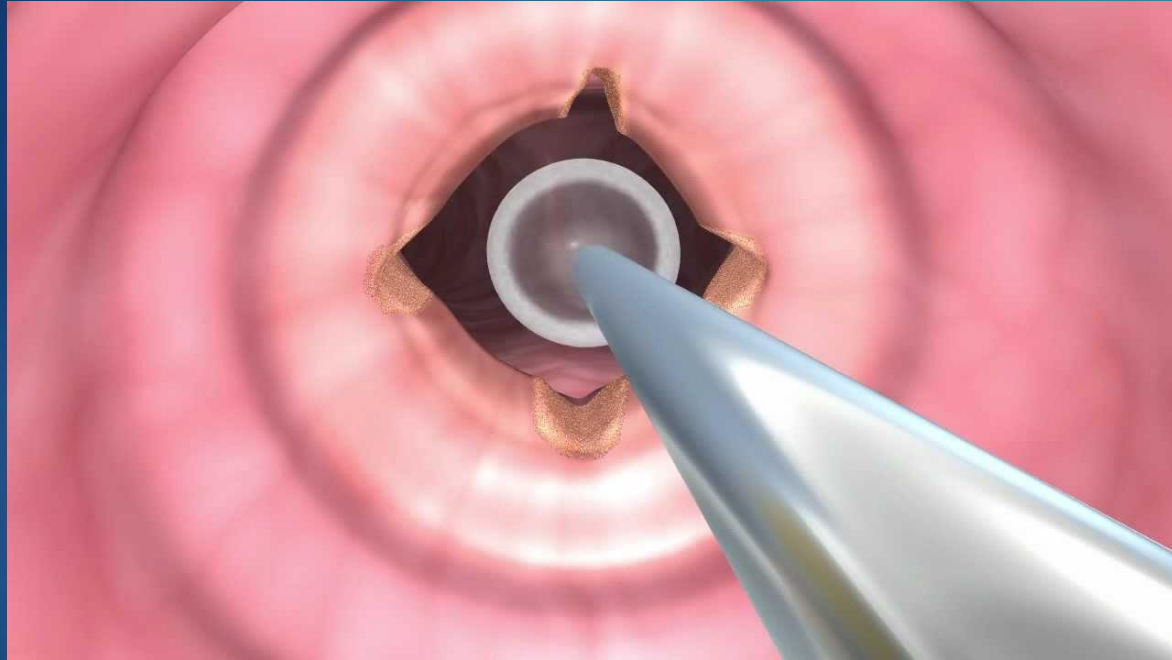


Project Scope

- ▶ High rate of recurrence
- ▶ Stent implant
- ▶ Need for a better solution
- ▶ Improve quality of life
- ▶ Airway expansion



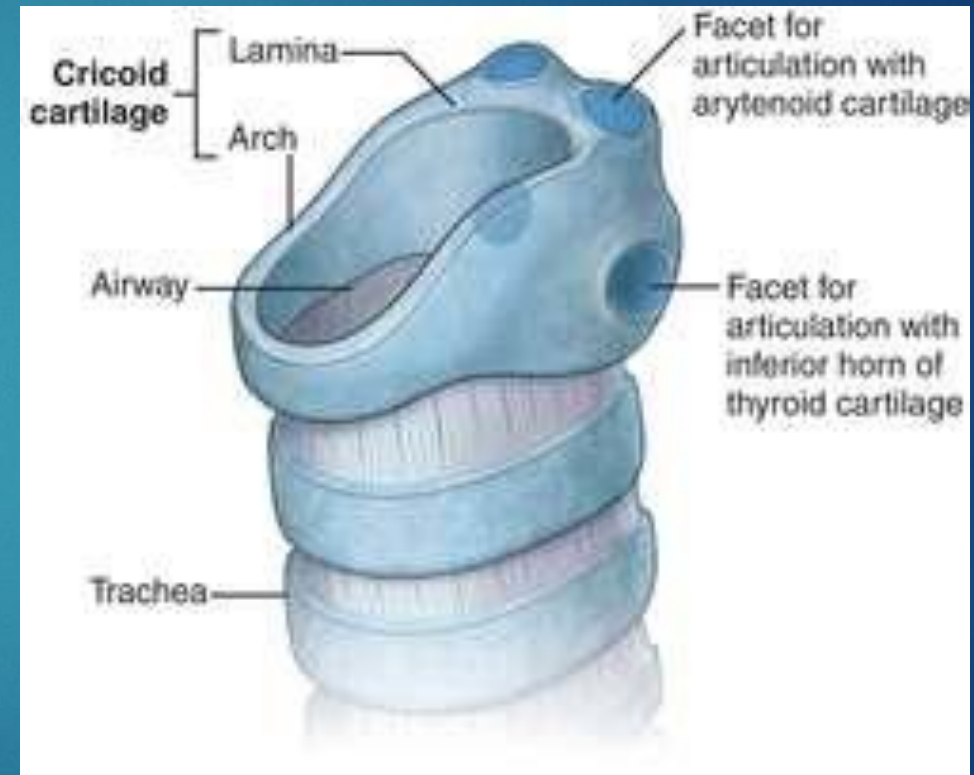
Project Scope



- ▶ Airway expansion and hysteresis
- ▶ Dr. Randal Paniello
- ▶ Cyclic application of pressure and relaxation
- ▶ Improved recovery response
- ▶ Limit potential for more scar formation

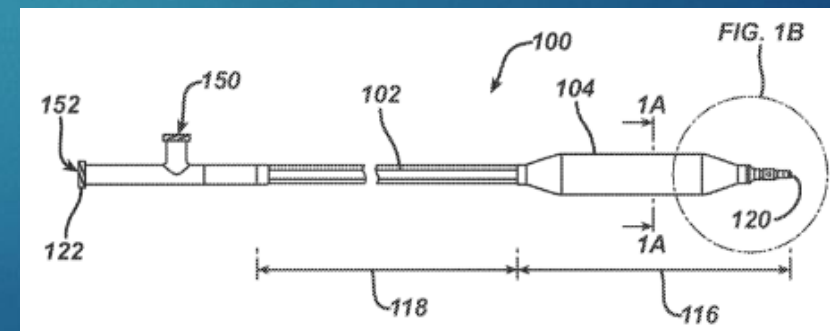
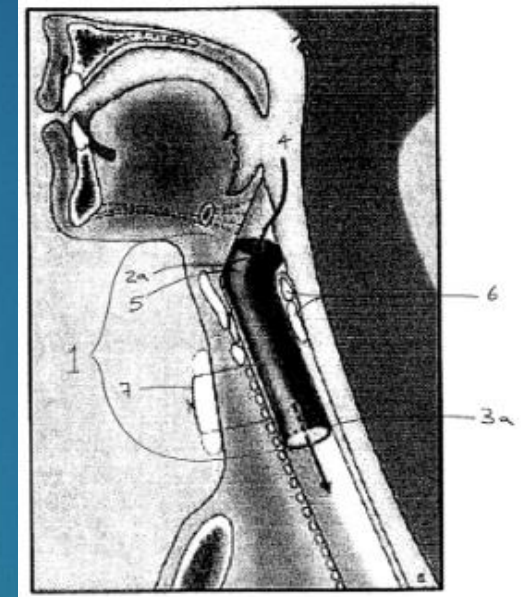
Design Specifications

- ▶ Dilate cricoid cartilage by 30%
 - ▶ 20-24 mm to 26-30 mm
 - ▶ Flow $\sim a * r^4$
- ▶ Radial pressure and relaxation
 - ▶ 5-10 min : 10-15 min
 - ▶ 7-8 atm
 - ▶ Preserve cartilage integrity
- ▶ Strength and biocompatibility
- ▶ Fit and implant status



Existing Solutions - Devices

- ▶ Medical devices – Grades I and II
- ▶ Surgical procedures – Grades III and IV
- ▶ Balloon catheter
 - ▶ SPO2 of 92%
 - ▶ Radial incisions
 - ▶ Improved models
- ▶ LT-Mold
- ▶ Bioabsorbable stent



Existing Solutions - Procedures

- ▶ Trachiotomy
- ▶ Anterior Cricoid split
- ▶ Laryngofissure
 - ▶ Anterior laryngofissure with a graft
 - ▶ With division of anterior/posterior cricoid lumina
- ▶ Larygotracheal Reconstruction (LTR)
- ▶ Cricotracheal resection

Team Responsibilities

- ▶ CAD Lead: Kyle Sachdev
- ▶ Programming Lead: Taylor Hughes
- ▶ Electronics Lead: Brian Dallesasse
- ▶ Group shared responsibilities
 - ▶ Interviews with SGS Patients
 - ▶ Prototyping and testing

Conclusion

- ▶ SGS is an obstructive airway condition characterized by scar tissue formation around the cricoid cartilage.
- ▶ Existing medical devices/procedures do not appreciably improve patient quality of life over the long term.
- ▶ There is a need for a device which expands the airway by hysteretic mechanisms.