Ergonomic Design and Evaluation of a Pilot Oxygen Mask

韓國空操縱士の酸素マスクの人間工學的設計および評價

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Introduction

Motivation

- Pilot OM designed based on US Air Force facial measurements
- Unfit to a significant percentage of Korean (or Asian) Air Force pilots
  - ⇒ Excessive pressure and/or oxygen leakage at the nasal root
  - ⇒ High level of discomfort during flight operation

⇒ Required a new OM design which is better fit to Korean Air Force pilots

Research Objectives

- Development and application of OM design method
- Validation of the proposed OM design

Methods

Virtual Fit Assessment (VFA)

- 3D scanning of Korean pilots' face (n = 336)
- Virtual Fit Assessment Method: automatically align OM CAD to 3D faces
- Found an optimal shape and size of OM for Korean pilots

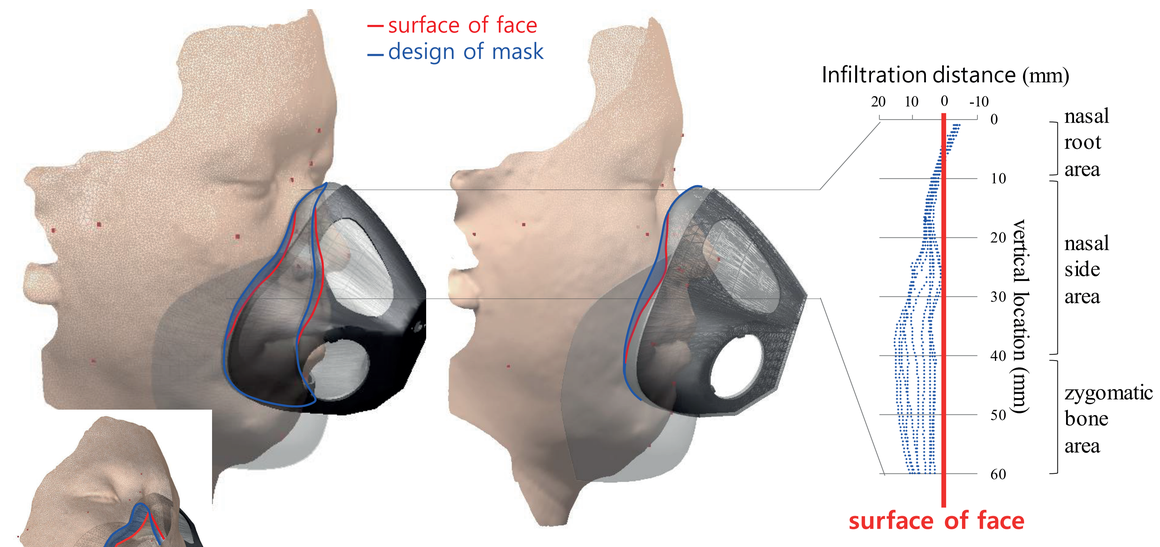

Figure 1. Virtual fit assessment

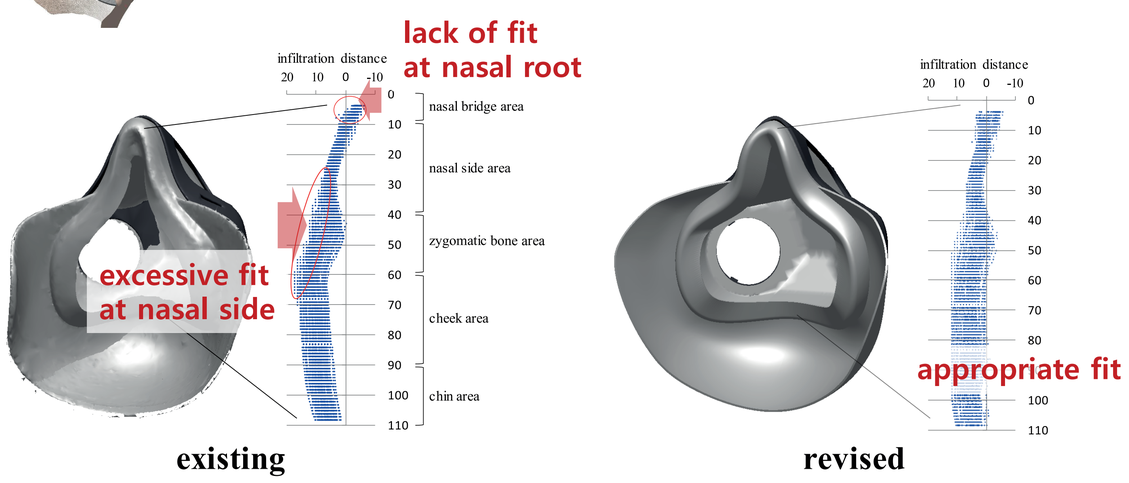

Figure 2. Evaluation of design satisfaction by VFA

Ergonomic Evaluation

■ Participants: 83 KAF pilots (M: 81, F: 2) currently using MBU-20/P

evaluation methods	results
1. Subjective evaluation based on questionnaire	• Discomfort: 32% ~ 81% ⇓ • 98% pilots were satisfied with revised design
2. Pressure evaluation using pressure film	• Pressure: 11% ~ 25% ⇓ • Pressed area: 24% ~ 33% ⇓
3. Suitability evaluation for military equipment at low atmospheric pressure, and high-G situations	• Found stable and secure in flight-like situation • Subjective slippage: 86% ⇓ • Slippage distance examined based on video analysis: 31% ~ 83% ⇓

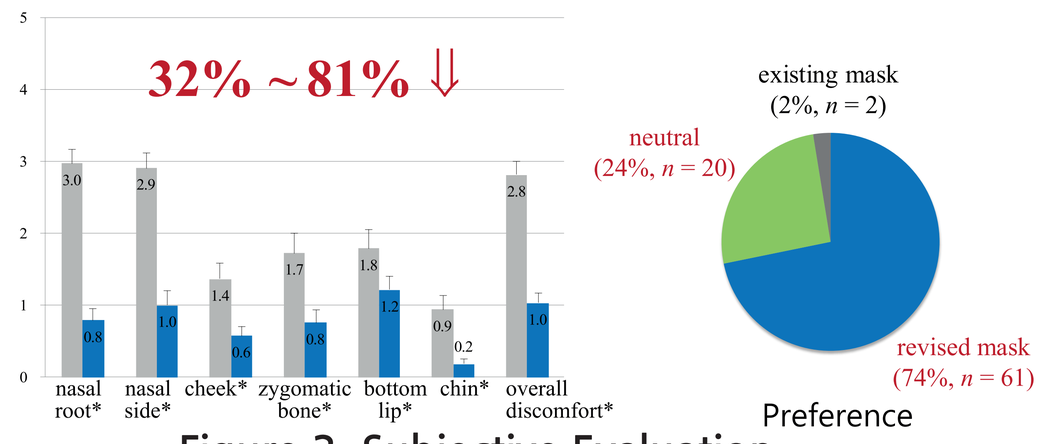

Figure 3. Subjective Evaluation

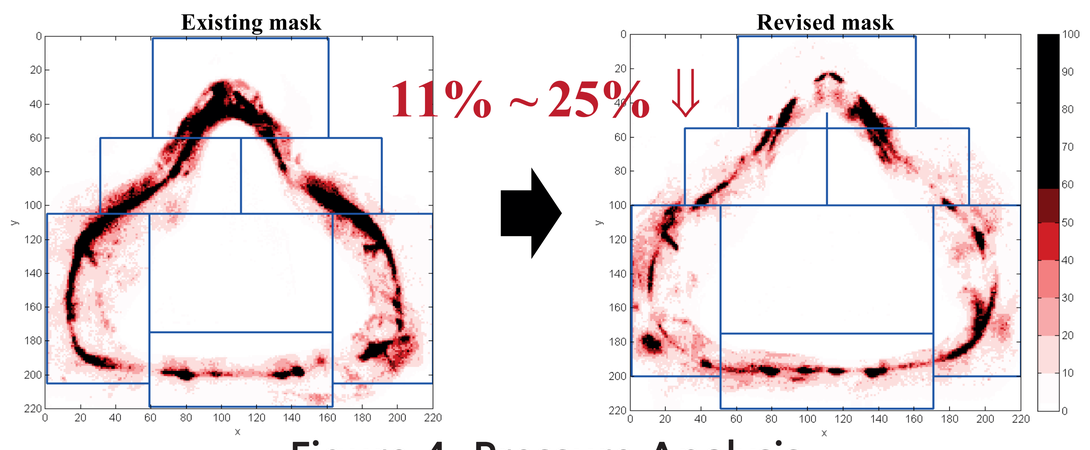

Figure 4. Pressure Analysis

Figure 5. Suitability Evaluation for Military Equipment

Contribution

- Support more comfortable and safe flight for Air Force pilots
- Design method using 3D scan and virtual fit assess ment applicable to ergonomic product designs (e.g., other types of mask, goggles, helmets, gloves, shoes, etc.)

more information: http://edt.postech.ac.kr