Evidence Based Design Of Face Masks For Children Using Computerized 3d Face Analysis

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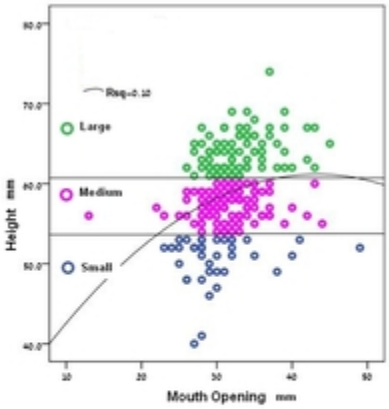
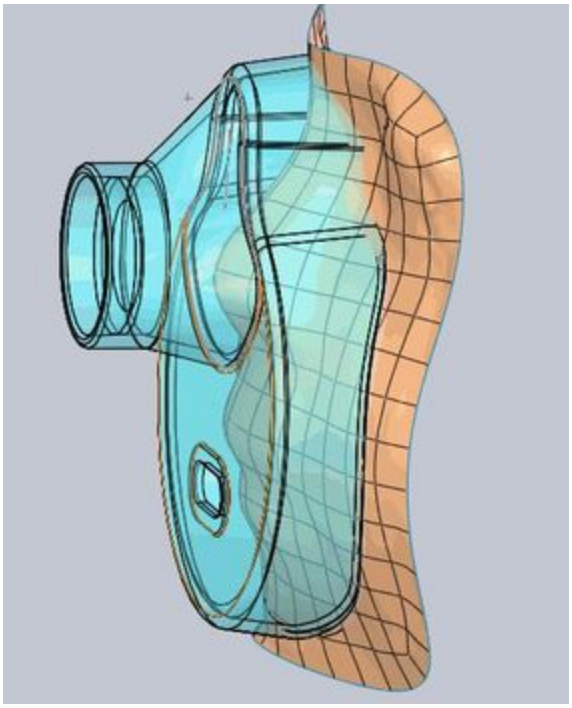
Rationale: Pediatric aerosol masks were originally developed for adults and then simply downsized for children. Overall fit to minimize dead space and a tight seal are problems since children's faces undergo rapid and marked anthropometric changes in their first few years of life. This study used face recognition anthropometric data to design an optimized pediatric mask.

Methods: Children's faces (N=271) were scanned using 3D-structured light technology from which surfaces were evaluated through facial pattern recognition software (Technion University, Israel). By comparing geometric features between faces, images were clustered into several distinct sub groups, each with its unique features, and an average facial structure was created for each cluster. The vertical height (from the nose bridge to the deepest point between the lower lip and chin) and the mouth opening horizontal distances provided the most reliable and reproducible measurements for our purposes. These were used to categorize the scans into small, medium and large size clusters (Fig. 1).

Results:
Fig. 1: Scatter plot of vertical and mouth opening dimensions
Fig 1



The average face models for each cluster were then used to design matching and optimally sealing masks with minimal dead space using appropriate software (Fig. 2).
Fig. 2: An 'average' model face with mask matching the facial topographical contour
Fig. 2



The resulting mask contour was used to develop the Soothermask®, a unique mask that enables children, suckling on their own pacifier inserted through a slot in the front of the mask, to create an effective and very gentle seal by means of atmospheric pressure on the pacifier disc with little additional caregiver force.

The mask has a relatively wide rim designed to both improve the mask-face seal, and accommodate variations in facial size within a cluster.

Conclusions: Soothermask® is the first mask, based on face-recognition techniques designed specifically for delivering aerosolized medications to infants and young children. It accurately follows facial contours and gently seals to the child's face, minimizing leakage of medication, and providing a small dead space with minimal application pressure.

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