A COMPUTATIONAL METHOD FOR EVALUATING FIT

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Respiratory protection requires a good fit of the respirator to the individual's face. A poor fit may result in the leakage and inhalation of contaminants. It may also cause discomfort to the user, especially during long operations. This is a serious concern since studies have shown that some workers, including emergency responders, are willing to discard protective equipment when they believe it impedes their ability to do their jobs. With the advent of powerful computational tools and laser scanners it is now possible to create digital representations of the complex geometries of human heads and respirator facepieces. These three-dimensional images can then be manipulated and subjected to computational analysis of how well a specific respirator operates for a specific user. A method is being developed for identifying areas of contact between respirator and face that are problematic for fit and comfort. Given digital geometries for head and respirator and the material properties of the respirator, the respirator can be computationally pushed onto the face distorting its shape as necessary until the head is "wearing" the respirator. As the respirator is pushed into place the software determines the areas of contact and contours of mechanical stress. Ideally the stress levels would be uniform around the entire seal. Contours of low stress indicate areas where leaks would be most likely and contours of high stress indicate areas where the respirator would be tightest to get a good seal and thus areas of greatest tactile discomfort. A demonstration of this method will be presented.