Regular Updates and Improvement of Monitoring Systems: continuously updating and enhancing monitoring systems and prevention strategies based on collected data and advancements in technology.

Conclusion. Research into potential water contamination risks highlights the critical role of thorough analysis and monitoring in ensuring water supply safety and user health. Implementation of effective preventive measures and responses helps preserve water as a vital resource and ensures water consumption safety.

It is recommended to further advance monitoring technologies, introduce innovative water purification methods, and enhance education on the importance of responsible water resource preservation and usage [1,2,3].

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DEFORMATION OF PALMAR HAND MEASUREMENTS IN A POWER GRIP BY WRIST ULNAR/RADIAL DEVIATION

An ergonomic power-grip handle designed by considering hand measurements, grip postures, and task characteristics can enhance productivity and usability in power-grip work. Power grips are widely used in various contexts, including manufacturing (e.g., hammering and drilling), vehicle operations (e.g., flight stick maneuvering), and daily living product uses (e.g., cooking and vacuum cleaning). The design of a grip that considers users' preferred grip postures, hand measurements, task characteristics, and usage environments can enhance fit, comfort, satisfaction, and motion efficiency. Additionally, it can increase productivity by inducing proper use of force and reducing physical workload on the upper extremity.

Several studies have investigated the optimal size of power grip for various cylindrical shapes and non-cylindrical shapes of grips by applying hand measurements, such as finger length ratios, and grip postures. Proposed a grip design for a vaginal ultrasound probe by applying finger length ratios to grip circumferences of designated grip sections and reported that the newly proposed grip design improved subjective satisfaction by 13.3%, wrist movement convenience by 2.5%–13.5%, and reduced muscular load by 0.4%–1.3%, compared to the existing grip design. Furthermore, suggested the optimal circumference of a pistol grip by analyzing hand dimensions and contact length and identified that the grip design based on contact length analysis increased usability in terms of perceived comfort and force distribution compared to the existing grip design. Next, measured grip force and contact area of cylindrical handle grips with various diameters (38–83 mm) and proposed an optimal handle diameter design equation based on finger segment length to maximize grip force. Lastly, developed an anatomically shaped power grip handle using discrete cylindrical handle grip postures and hand shapes applied with optimal handle diameter design equations by finger and reported that the newly developed handle increased contact area by 25%, fit by 35%, grip comfort by 61%, and overall comfort by 54%, compared to the cylindrical handle.

The grip width, grip height, and grip circumference were identified for each finger in the present study as key design dimensions of a power grip. The cross-sectional shape and size of a power grip can significantly affect force exertion, operating posture, and grip comfort when using a hand-held product. A power grip was divided into four cross sections for the four fingers (index, middle, ring, and little fingers; Fig. 1a) and the cross-sectional shape and size of the grip for each finger were represented by the corresponding grip width, grip height, and grip circumference (Fig. 1b).

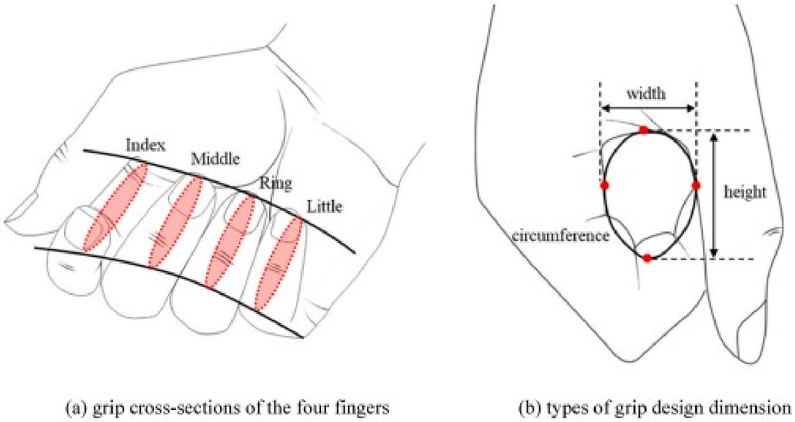

Fig. 1. Power grip design dimensions.

In this experiment, aimed at measuring the palmar hand dimensions by wrist posture, several instruments were utilized, including (1) an angle adjuster for the wrist, (2) a fixture for the elbow, (3) an electrical goniometer, (4) casting material, and (5) a hand scanning system, as shown in Fig. 2. The angle of wrist abduction/adduction of the participant was controlled using an angle adjuster with a stick, while the elbow was fixed at 45 degrees of flexion using an elbow fixture. The stick angle adjuster consisted of a stand with an adjustable handle (diameter = 15 mm) in angle and height to control the radial/ulnar deviation of the wrist in accordance with an experimental condition. The angle of the stick adjuster was controlled using a digital goniometer to ensure that the wrist angle was maintained at the designated angle during the experiment.

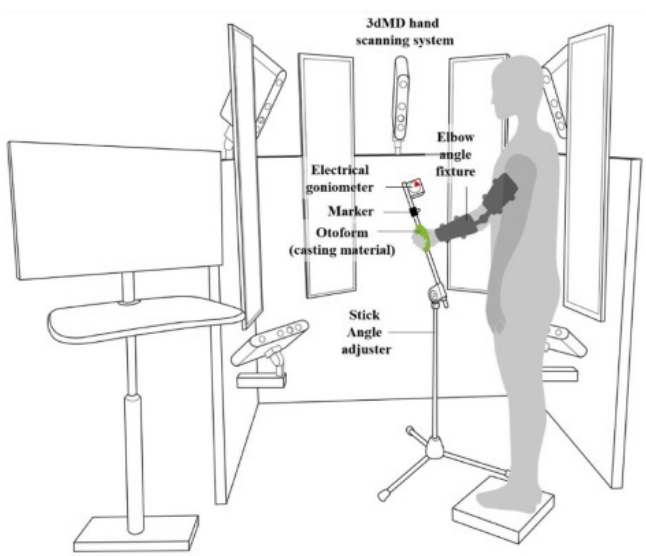

Fig. 2. Experimental layout for palmar hand dimension measurement.

The findings demonstrated the significance of measuring the palmar hand dimensions for grip design, overcoming the limitations of previous studies focused on cylindrical handles. The study identified preferred grip dimensions, including width, height, and circumference, considering finger type, hand size, and wrist posture. The study recommended tapered grip shapes to accommodate wrist radial/ulnar deviations and provided insights for designing grips that accommodate wrist posture variations and hand size. It also highlighted the influence of hand size on palmar hand dimensions, indicating proportional decreases in grip width, height, and circumference with increasing hand size. Future research is needed to explore additional hand postures, evaluate grip performance objectively, and consider diverse populations.

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