Grip & Tool Designs

Hand-held tool designs have evolved over the years from individually owned tools to tools that have to accommodate a number of different workers. In the past, tools were constructed to fit an individual worker's physical dimensions, which determined the size & shape of the tool. Each worker took his tools with him from job to job. There was some recognition early in man's evolution a tool that was a good fit made it easier & more efficient to use. This is evidenced by the progression of axe handle designs which demonstrate that man attempted to improve the interface between himself, his tools, and the task for which the tool was used. Tools that are not customized to each worker can lead to a loss in the transmission of power, unbalanced pressure distribution, and can impact work efficiency. Poor tool design can ultimately lead to occupational musculoskeletal injury. Today's work methods have resulted in tools that have multiple uses, as well as multiple users. Therefore, a tool design has to accommodate the physical dimensions of the majority of users.

This is especially true of ultrasound transducers. Unlike the fixed components of the ultrasound system, transducers are somewhat freely moveable and require a certain amount of force and upper extremity motion to use. It is clearly impractical and cost prohibitive for multiple transducers to be designed to fit each individual sonographer, as well as every exam requirement.

A number of factors enter into the design of transducers, including weight, center of gravity and the material with which it is constructed. Additionally, there are other factors to consider, such as type of exam, use of the transducer by both left and right-handed workers and by both male & female workers and how sonographers prefer to hold the transducer. Furthermore, the transducer should have a shape that preserves a neutral wrist position.
New exam types, such as endocavitary and intraluminal exams, have necessitated innovative transducer designs with longer, narrow handles. The increasing use of ultrasound for guidance during interventional procedures brings up other design considerations, such as biopsy guides on the transducer and ease of manipulation of the transducer during those procedures.

Regardless of the amount of research and the changes that have been incorporated into transducer designs, the most important component in the user-machine interface is the sonographer. The shape of the transducer should promote a palmer grip using the entire hand; however, the sonographer must adjust his or her grip so that the hand is comfortable and the transducer is not being held using the small muscles of the fingers.
By supporting the scanning arm, a sonographer can reduce stress to the hand and forearm caused by the weight of a transducer. Any hand tool should be used with the arms held close to the body. Therefore, sonographers should position their patients to reduce arm abduction and reach while scanning. The design of any tool is only effective if it is used in an ergonomic manner.

Transducers will continue to evolve and new applications will continue to be identified. It is important, therefore, that imaging professionals grow into those changes and be creative and flexible in how they use their tools.