

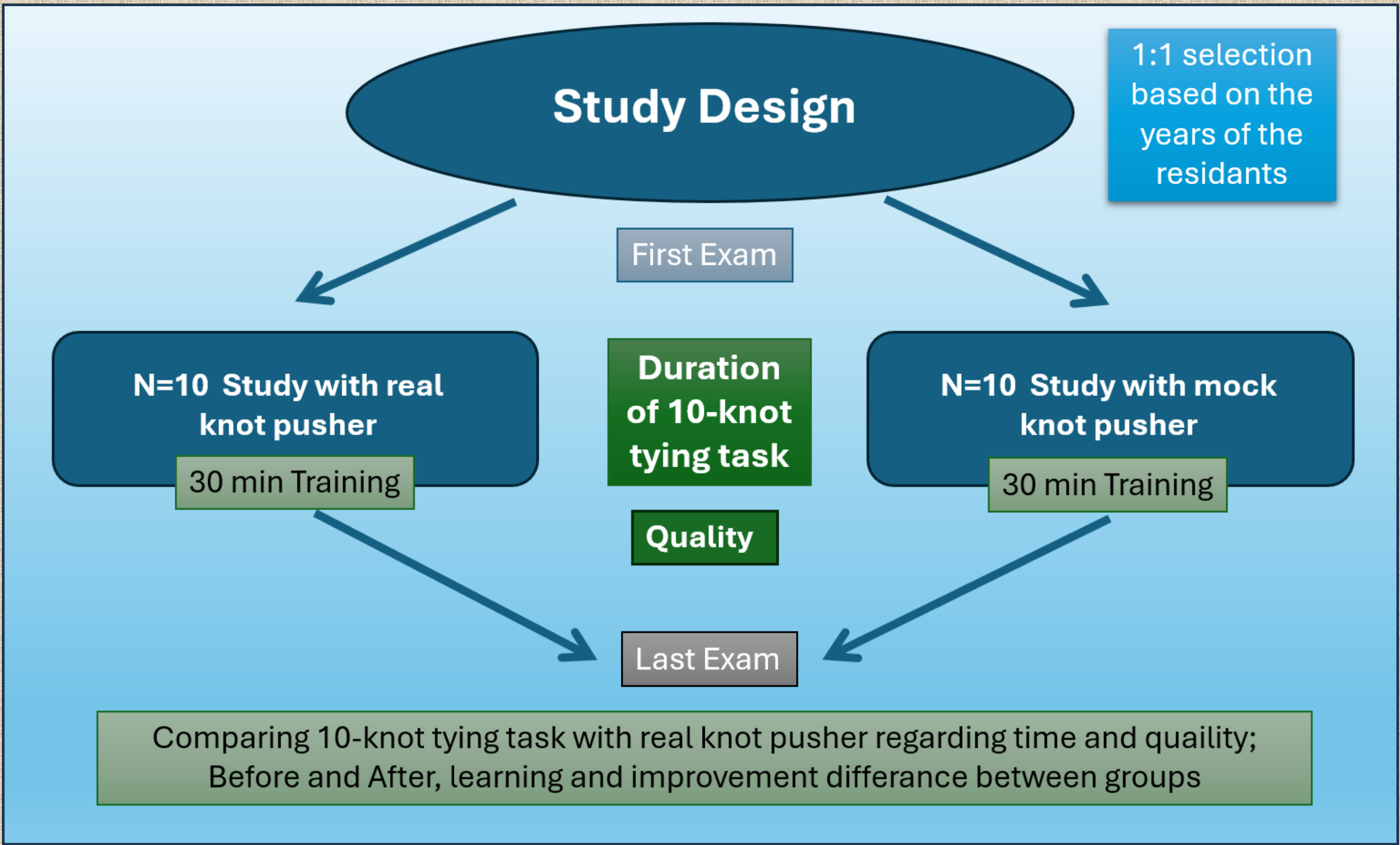
### Introduction:

Minimally invasive cardiac surgery (MICS) has transformed surgical practice, yet the high cost and complexity of specialized instruments pose significant challenges, especially for residents during training. To address these barriers, we designed a simple and accessible knot pusher made from chopsticks, providing an innovative tool to enhance surgical knot-tying skills.



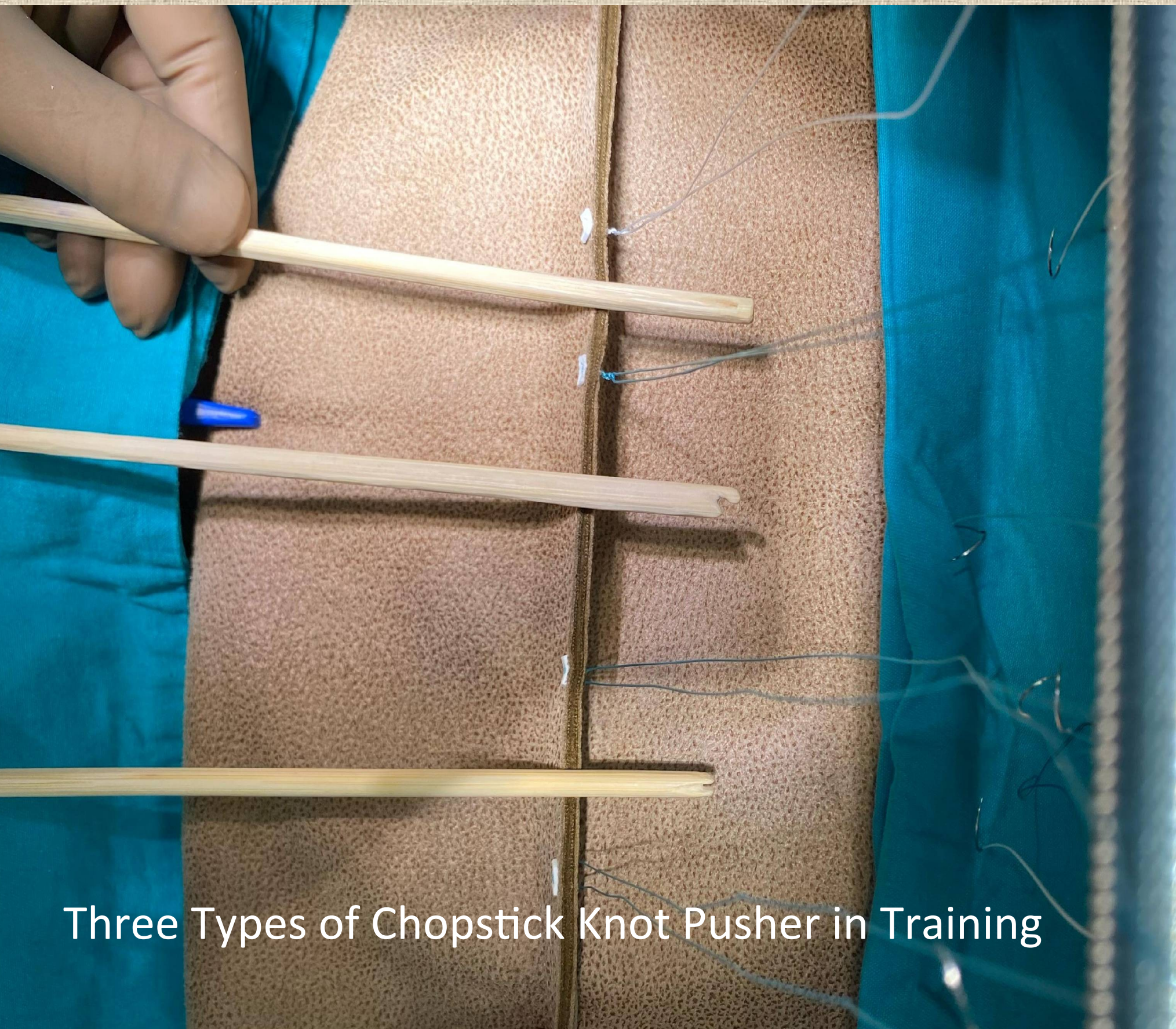
### Methods:

We designed the knot pusher from chopsticks, modified for MICS training. The device was tested by residents performing knot-tying task. Twenty surgical residents were divided into two groups: Group 1 (n=10) trained with the standard knot pusher, and Group 2 (n=10) used the chopstick knot pusher for 30 minutes. Knot-tying performance with standard knot pusher was evaluated before and after training, with time and quality to complete 10 surgical knots recorded. Knotting speed and quality were analyzed using the Wilcoxon or McNemar, and between-group comparisons were performed with the Mann-Whitney U test or Chi-square.



### Results:

The first knotting time and quality noted similar for both as median time: 45.5 sec (IQR: 43.5-49.5) with 70% inadequate quality vs 43.5 (IQR: 37.5- 48.5) with %90 inadequate quality (p=0.32 and p=0.58). All residents demonstrated a significant reduction in knotting times and improved quality after training (p< 0.01 p<0.01). Post-training, the mean knot-tying times and quality revealed as median time: 32.5 sec (IQR: 28.2-33.7) with 70% adequate quality and 30 sec (IQR: 27.2-34) with 80% adequate quality in standard vs chopstick (p=0.64, 0.58). The overall median time reductions for group were 14.5 (IQR: 11-17) with 40% improvement quality and 13 sec (9.7- 15.2) with 70% improvement quality (p=0.42, p=0.33).



### Conclusions:

Chopstick based knot pusher is a low-cost and accessible alternative for knotting task in MICS training. While its application is limited to basic knot-tying, it provides an effective starting point for residents to practice surgical fundamentals