



# Force Transmission In Offset Broach Handles Used For Hip Replacement: Comparison Of Three Different Designs

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## INTRODUCTION:

In minimal invasive direct anterior total hip arthroplasty double offset broach handles are used, in order to facilitate the preparation of the femoral canal. The aim of this study was to quantify the differences in force and impulse transmission in the impact direction of the broach tip between two versions of double offset broach handles (A European version, B American version) and a single offset broach handle (S).

## METHODS:

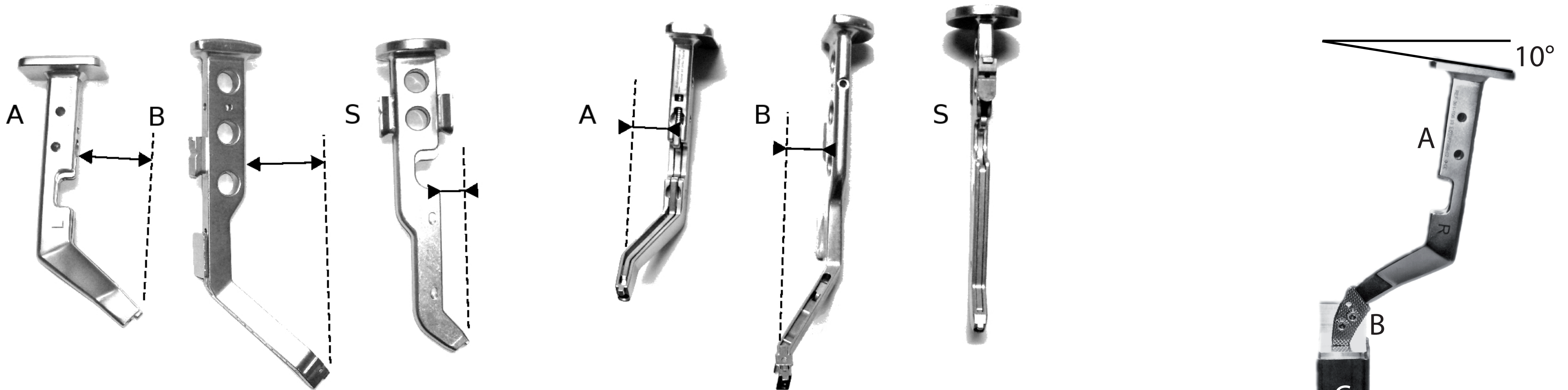


Fig. 1: Frontal and lateral view of Double offset A (European version), Double offset B (American version) with anterior and lateral offset and single offset broach handle S with anterior offset.

Two types of double offset broach handles were compared to a single offset broach handle (all Stryker, Mahwah, NJ-USA) **Fig 1**. An impact hammer was used to carry out 30 measurements for five different falling heights for each broach handle. The force variations measured by a load cell connected to the broaches were used to obtain the maximum force peak and to calculate the impaction impulse **Fig 2**. Since not all data was normally distributed the non-parametric U-Test was used for further analysis.

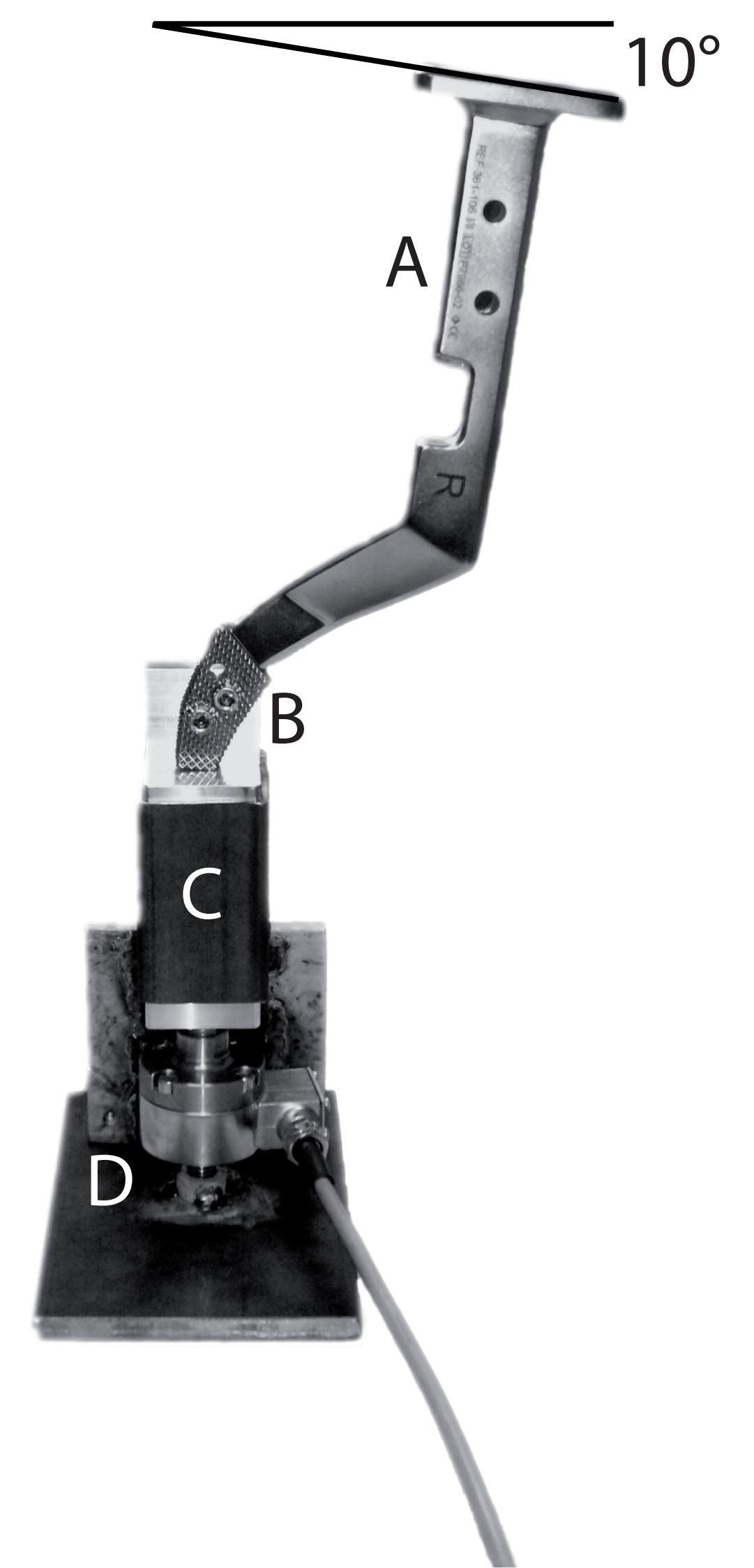
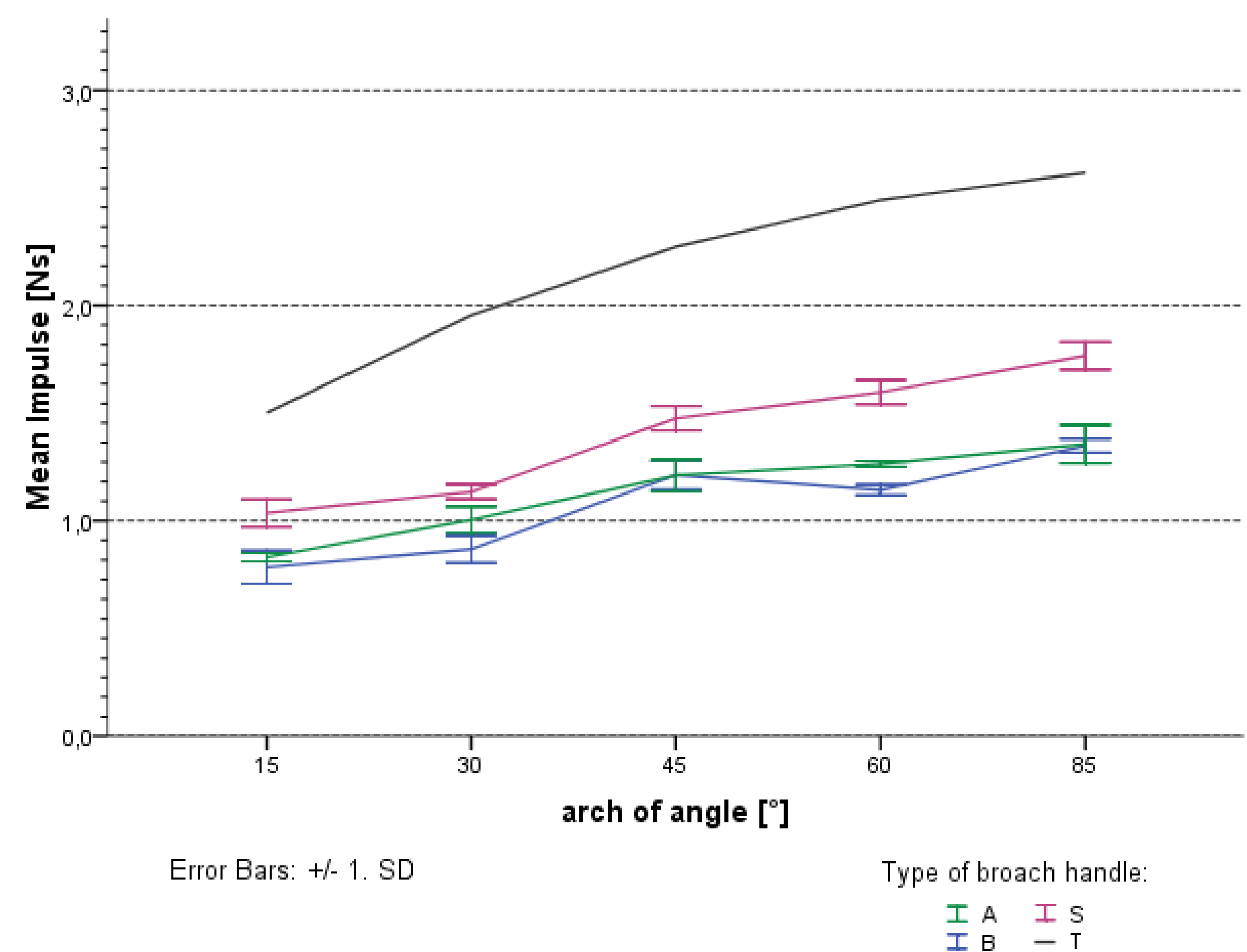
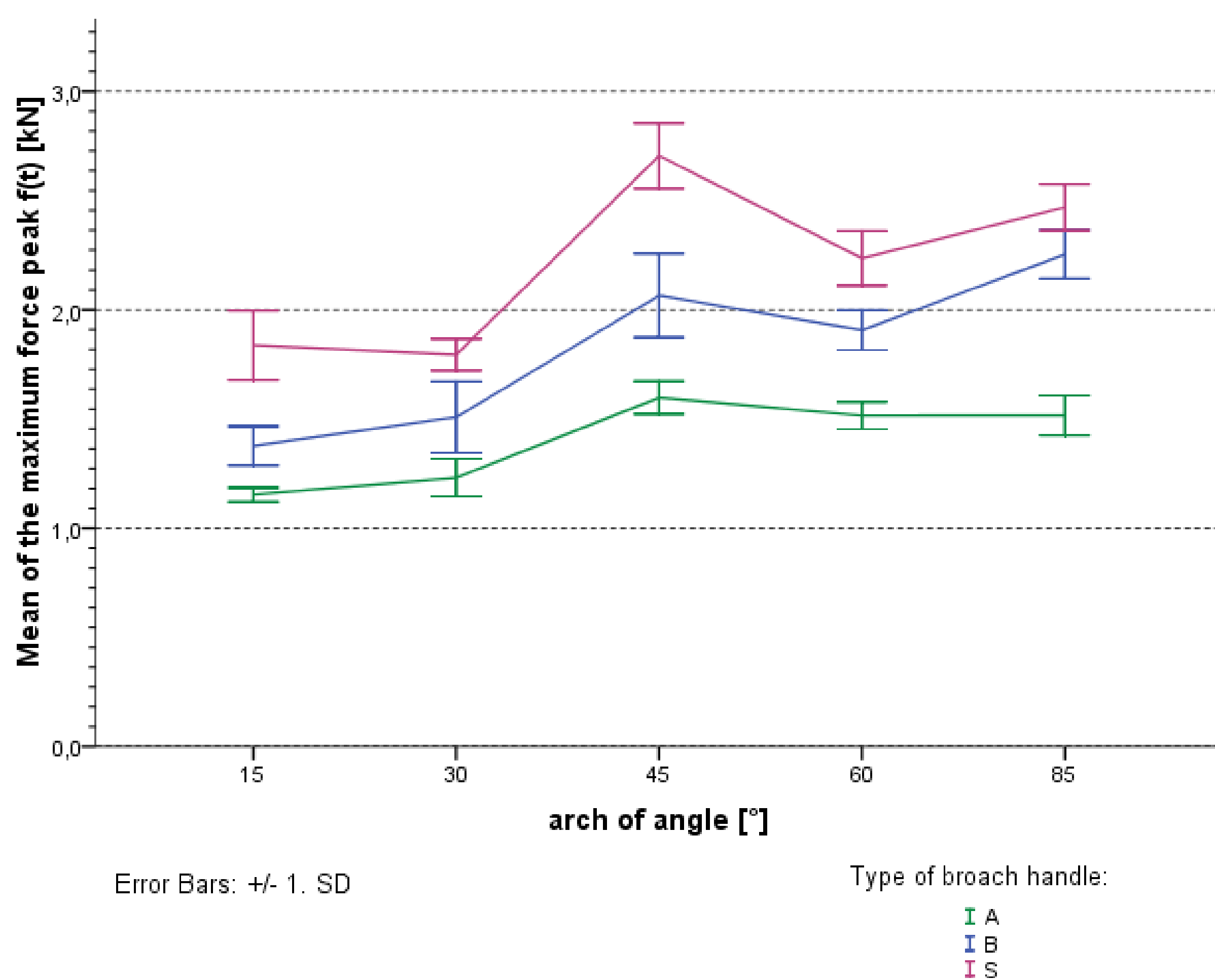


Fig. 2: Schematic overview of experimental setup: A broach handle, B modified broach, C guide, D Load Cell.

## RESULTS:

The single offset broach handle has the highest force peak value (18% higher than B and 36% higher than A) and a 24% higher impulse value than B and a 19% higher impulse value than A. Broach handle A had higher impulse values (5%) and lower maximum force values (18%) compared to broach handle B. The differences between the three broach handles considering maximum force peaks and impulse values were statistically significant ( $p < 0.001$ ). Since the Impulse values T were calculated from a theoretical model no error bars were reported in the graph.



## Conclusion:

Higher instantaneous force peaks could increase the risk of bone fracture. We assume that the contact surface during the impact is a determining factor in reducing the maximum force peak. However as the material properties of the broach handles were unknown, this behavior can be attributed also to the elastic properties of the broaches. Introducing a lateral lever arm has a measurable effect in double offset broach handles, as less energy is transmitted in the direction of the tip.