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Research Article

Prediction of Plate Screw Length from Head Screw Length in Dynamic Hip Screw- A Descriptive Observational Bone Study

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Abstract

Introduction: To study the correlation between head screw length and plate screw length of 135-degree dynamic hip screw (DHS) using osteological assessment of 61 femoral bone specimens.

Materials and Methods: 61 femoral bone specimens were procured from the department of anatomy. The head screw length of each specimen was calculated at 135 degrees using a goniometer. The plate screw positions were calculated with standard size 5 holed dynamic hip screw from A.O. Corresponding femoral diameters were taken with gauge as the screw length and this data was analyzed statistically to analyze the relation between plate length and head screw length.

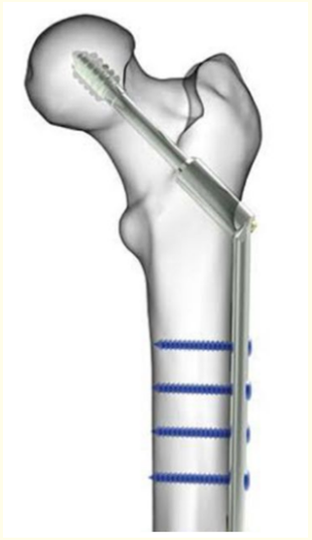
Results: The median value of plate screw 1 to screw 5 showed an increase in size with increase in head screw sizes. There is a decline in the screw size values from proximal to distal. Maximum usage was observed for plate screw length 28, 26 and 30 respectively.

Conclusion: The mean and median of the plate screw length increases proportionately with the head screw length. The plate screw length for a particular head screw decreases from proximal to distal screws.

Keywords: *Plate Screw Length; Head Screw Length; Dynamic Hip Screw*

Introduction

Hip fractures represent an important health-care dilemma, costing billions of Dollars annually [1]. With the life expectancy improvements, better health care provisions, emerging social awareness there has been a significant increase in the number of Hip fracture surgeries in the last few decades. Many of these patients have comorbidities associated with old age like Diabetes Mellites, Hypertension, Cardiovascular diseases which will decide the outcome of the procedure [2]. Hence it is very important to reduce the controllable morbidity factors like operative time, blood loss, fluoroscopy exposure to minimum. In this study we are analyzing bony specimens' morphology with respect to a DHS. It was hypothesized that the plate screw length increases with increase in head screw length. Finding such relationship between this will help to control this controllable morbidity factors to a certain extent.



Figure

Materials and Methods

Data collection

An institutional review board approval was obtained before initiation of the study. A standard A.O 5 holed DHS (130 Angle) was chosen as the implant in the study. The distance of the five plate screw holes from the centre of the head screw was marked and measured. We examined femoral bones collected by the department of anatomy. 61 bone specimens were finally included in the study. Bones with defects, non-adult bones and bones with deformities were excluded from the study.

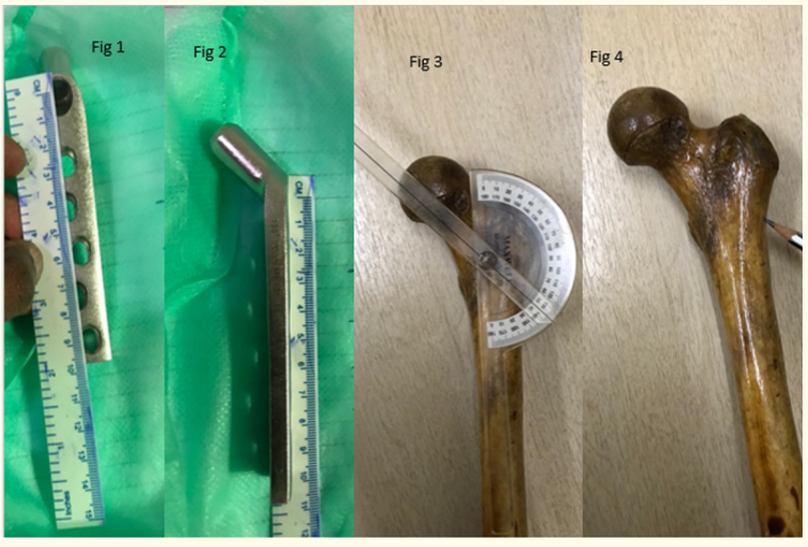


Figure 1 and 2: *Measuring the distance of centre of plate screw holes from center of head screw.*

Figure 3: *Goniometer with 135 degree angle with fovea capitis as land mark.*

Figure 4: *Marking the center of head screw.*

Each specimen was carefully examined and the center of head screw position on the lateral cortex was marked using a goniometer with the center of the fovea as landmark. The screw positions were marked with marking pen and corresponding femoral diameters were taken with a measuring gauge in all five screw positions. The evaluation and measurement of all specimens were done by 2 separate investigators and the mean value of the same was taken in for statistical assessment. The head screw length was estimated as Distance from fovea to centre of head - 5 mm. Assuming the head screw reaching subcortical screw. The 5 plate screw measurents was taken with a caliper on the 5 plate screw center markings. The value was rounded to the next even number to determine the plate screw length.

Figure 5: *Marking the plate screw centers on bone with marker and scale.*

Figure 6: *Taking plate screw measurements with caliper.*

Statistical analysis

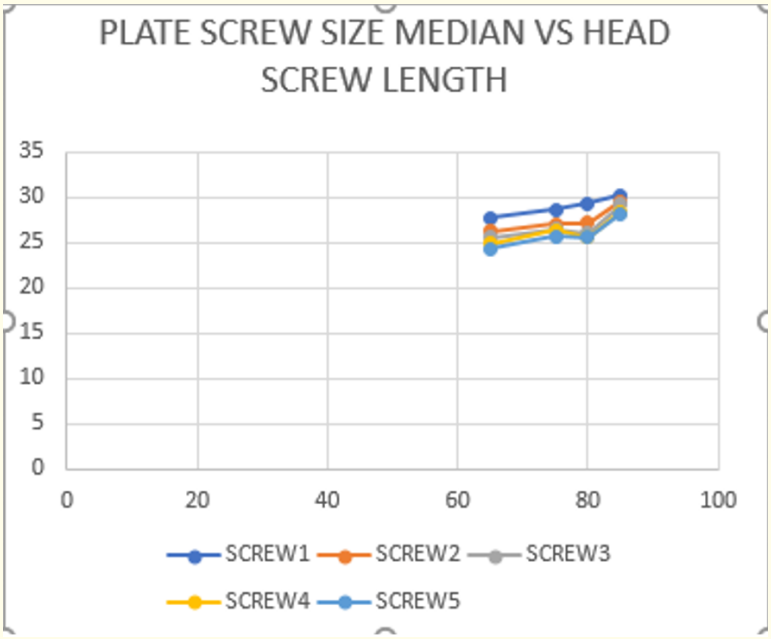
We collected the data using Microsoft excel and processed with SPSS 22 version application. The Data was compartmentalized to different head screw sizes and mean, median, quartile interquartile range were noted. And was analyzed separately for each head screw sizes.

Results

The relationship between the head screw size and the plate screw size were analyzed. Since the screw size data showed some extremes of measurements, median of the values were preferred over the mean average. Being a pilot study that deals with DHS and proximal femoral morphology, we would like to make a note of the following observations. Majority of the femurs had head screws of sizes 65 (10 nos), 70 (14 nos), 75 (20 nos), 80 (11 nos). The median and mean of plate screw sizes were found to be increasing with an increase in head screw lengths. There is a steady decrease from screw sizes from plate Screw 1 to screw 5 although Plate screw sizes of S3 S4 S5 were almost the same for all the samples.

Head Screw Size	Screw 1	Screw 2	Screw 3	Screw 4	Screw 5
65	27.69	26.26	25.57	24.82	24.35
75	28.59	26.99	26.51	26.36	25.62
80	29.26	27.14	25.96	25.53	25.55
85	30.22	29.55	29.21	28.35	28.13

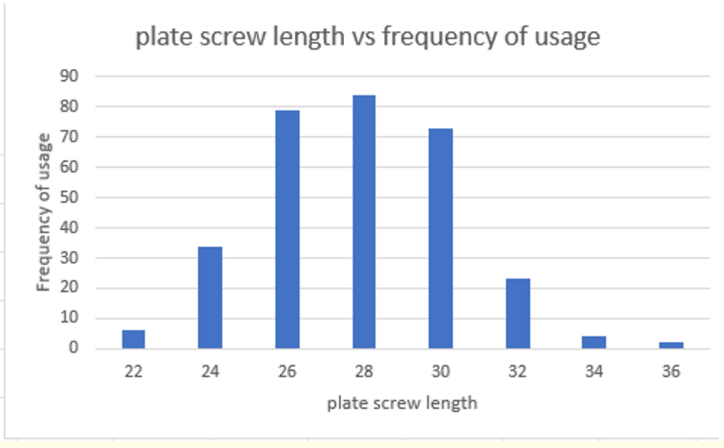
Table 1: *Head screw size and median of plate screw 1 to 5.*



Graph 1: *Showing Increase in plate screw with head screw size.*

Plate Screw Size	Frequency
22	6
24	34
26	79
28	84
30	73
32	23
34	4
36	2

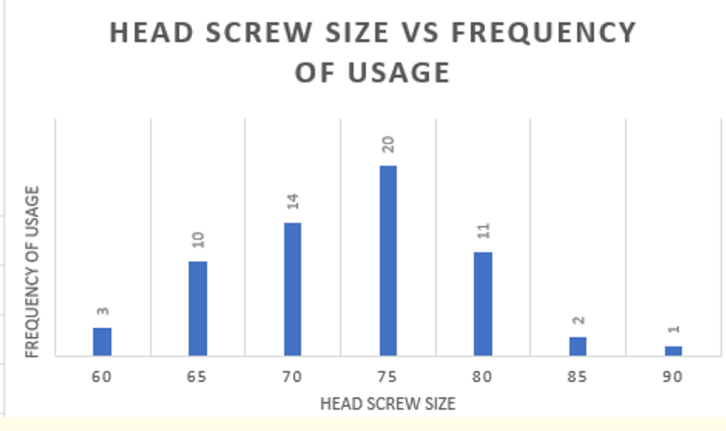
Table 2: *Plate screw size vs frequency of screw used.*



Graph 2: *Plate screw length vs frequency of usage.*

Head Screw Size	Frequency
60	3
65	10
70	14
75	20
80	11
85	2
90	1

Table 3: *Head screw size and frequency of usage.*



Graph 3: *Head screw size vs frequency of usage.*

We also analysed the frequency of usage the plate screws and head screws in the overall study (Table 2 and 3). The distribution of both plate screw and head screw usage showed a typical bell-shaped graph as depicted in graph 2. The highest plate screw usage was observed with size 28 screw followed by 26, 30, 24, 32 respectively. And the highest Head screw usage was observed for 75, 70, 80, 65 respectively.

Discussion

With the life expectancy improvements, the exponential increase in geriatric population, the global number of hip fractures is estimated to increase from 1.26 million in 1990 to 4.5 million by 2050 [3]. Dynamic hip screw (DHS) has been the most preferable method for years, beating its competitors for several decades till recently [4]. Development of DHS in the 1950's revolutionized the management of intertrochanteric fractures and it's still continuing to be the implant of choice for many surgeons [5]. Larger exposure, increased operative time, increased blood loss, are some of the disadvantages encountered with DHS [6]. Its still a debatable subject to identify the ideal implant for an intertrochanteric fracture [7] although many literature works, bring up different winners from time to time.

In our study we inspected the relationship between head screw sizes and plate screw length of various bone samples using standard 5 holed A.O DHS implant. This study is the pilot study in this subject. We observed a decrease in plate screw size from screw 1 to screw 5 (from proximal to distal) for all the specimens. But Plate screw lengths of distal three screws were more or less the same.

In a clinical scenario in most of the cases the distal 3 plate screw sizes will be same. Since the sample size of the study is small, we cannot predict the plate screw lengths from head screw sizes with absolute certainty. Therefore, we strongly suggest to take the measurement of proximal most plate screw (screw 1). The rest of the screw sizes can be predicted by reducing one screw size less for second screws (screw 2) and two sizes less for the distal most 3 screws (screws 3, 4, 5). This can be used for bringing the surgical time less and to avoid unnecessary exposure to fluoroscopy. There are studies which says equal surgical time for DHS and PFN although majority of the studies record more time requirement for DHS surgery. These small observations help us to avoid the time wastage and aid in the better outcome of the treatment.

In our study we also assessed the distribution of the plate screw lengths and head screw length for all the femur samples. We got a bell-shaped curve of distribution for both plate screw length and head screw length. The maximal plate screw usage was noted for size plate screws 28, 26, 30. And maximum head screw size usage was noted for size 75, 70, 80, 65. So, when you get a value away from the peak of the distribution curve, we suggest to double check your measurement and confirm under fluoroscopy.

Conclusion

The mean and median of the plate screw length increases proportionately with the head screw length. The plate screw length for a particular head screw decreases from proximal to distal screws. The usage of plate screw and the head screw follows a bell-shaped distribution curve.

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