

Investigation of Temperature Distribution during Bone Drilling By Optimizing Helix Angle of Drill Bit

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Abstract — Eight types of configurations of drill bit were used i.e. 10, 12, 12.5, 14, 14.5, 16, 16.5, 18 mm. An optimized model of drill bit has been developed as stated configurations of drill bit with different helix angle. The experimental investigations have been performed at a standard temperature that is the temperature generated during drilling process. The experimentation of the optimized model gives lower value of temperature distribution. The results are validated with reported existing previous work. The configuration of drill bit of helix angle 12.5 degree exhibits lower temperature distribution compared to other configuration.

Keywords: Drill Bit, Bone Sample, Temperature Distribution, Drilling Process, Experimental Investigation, Feed Rate, RPM

I. INTRODUCTION

Drilling of bone is one of the commonplace surgical steps. Surgical remedy consequences are in large part prompted by the surgical abilities of surgeons and the performance of clinical devices. Then, it is critical in particular in Japan, the most brilliant-aged society in the global, that surgical training of docs and development of excessive-performance medical devices must be finished correctly. Biomodels can characteristic to satisfy the unexpectedly increasing demands for scientific assets. Bone biomodel is one of the biomodels that replicate human tissue, and recognized for its usage in surgical training for docs or mechanical exams of medical

devices. A quantity of bone biomodels are currently available inside the marketplace, but the reproducibility of drilling of bone has little been paid interest and slightly been in the research scope up until today. Therefore, conventional bone biomodels cannot absolutely reproduce the specific drilling conduct of natural bones. Besides, evaluation items among bodily and mechanical residences of biomodels toward the replication of drilling of bone is uncertain.

II. PROBLEM FORMULATION

The survey of different previous works we predict the temperature is maximum as compared to present study is shown in our base paper. The purposes of this study minimize the temperature effect in bone sample and decrease the thermal effect with different helix angle and feed rate.

III. RESULTS:

RPM 3000	
Helix Angle (12 Degree) & RPM 3000	
Feed rate (mm/min)	Temperature (Degree celcius)
10	5.73
15	5.78
20	5.88
25	5.93
30	6.21

Table 1: Results 12 degree helix angle drill bit.

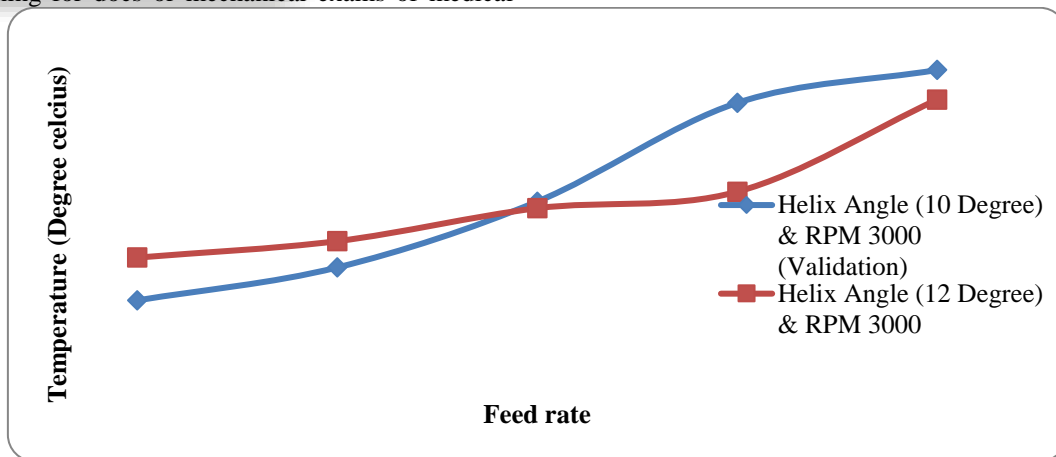


Fig. 1: Comparison of temperature distribution for bone sample with 12 degree drill bit.

RPM 3000	
Helix Angle (12.5 Degree) & RPM 3000	
Feed rate (mm/min)	Temperature (Degree celcius)
10	5.16
15	5.26
20	5.38
25	5.42
30	6.18

Table 2: Results obtained for 12.5 degree helix angle drill bit.

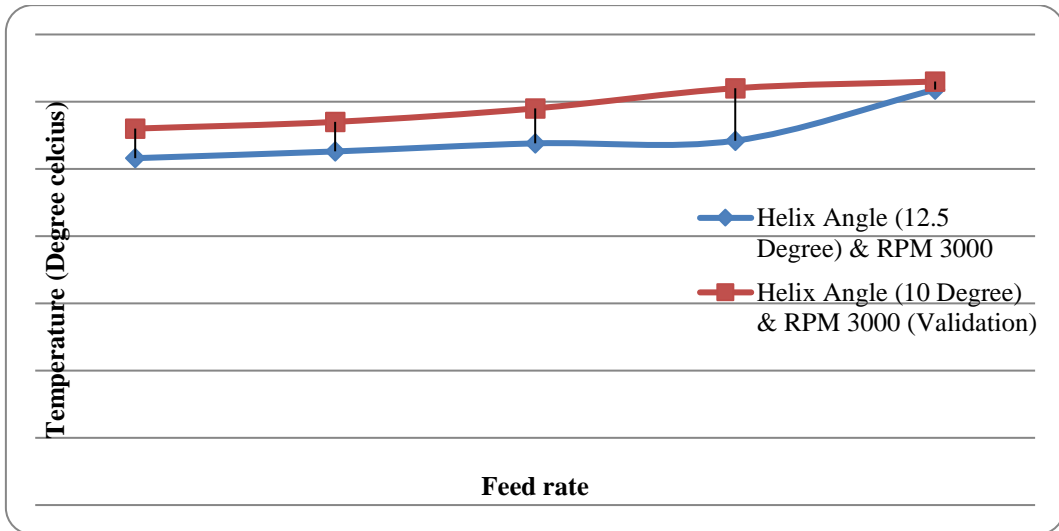


Fig. 2: Comparison of temperature distribution for bone sample with 12.5 degree drill bit. The above graph represents the comparison of temperature distribution with respect to feed rate with validation result for bone sample drilled with drill bit of helix angle 12.5 degree.

RPM 3000	
Helix Angle (14.5 Degree) & RPM 3000	
Feed rate (mm/min)	Temperature (Degree celcius)
10	5.76
15	5.82
20	5.94
25	5.97
30	6.32

Table 3: Results obtained for 14.5 degree helix angle drill bit.

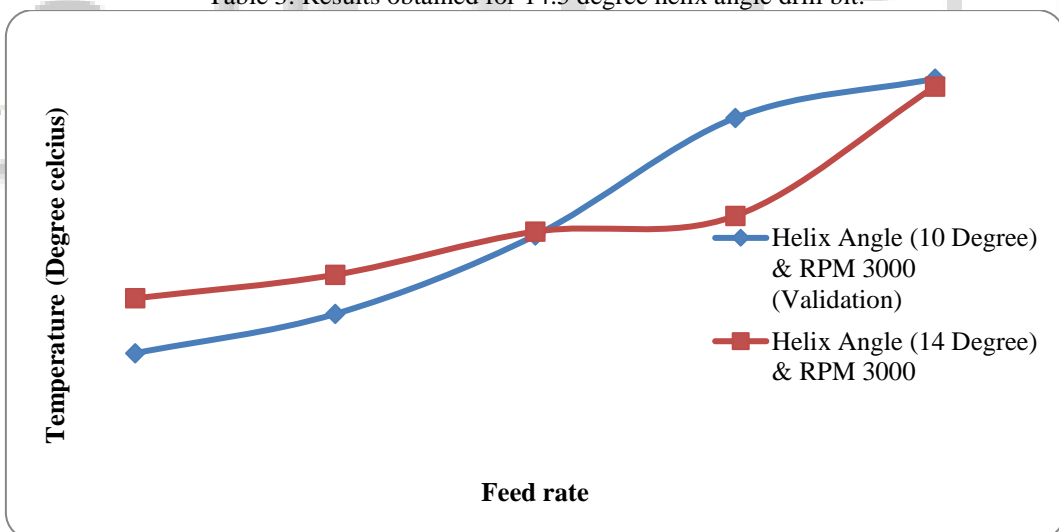


Fig. 3: Comparison of temperature distribution for bone sample with 14.5 degree drill bit. Overall comparison of temperature distribution with different feed rate and constant RPM:

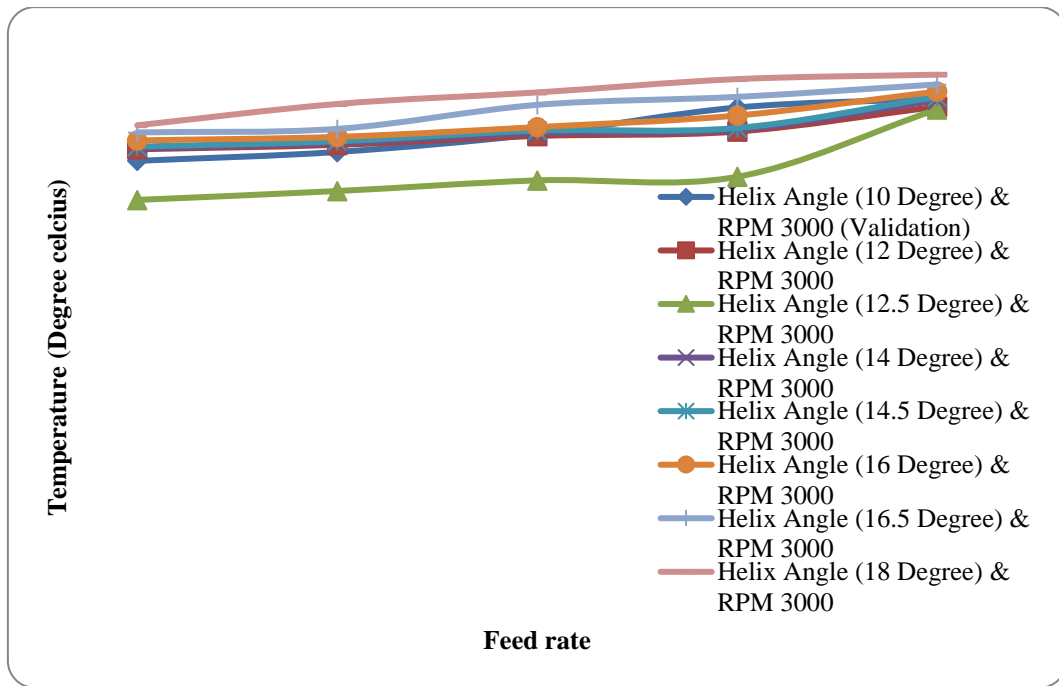


Fig. 4: overall comparison of temperature distribution with respect to feed rate

The above graph represents the overall comparison of temperature distribution with respect to feed rate with validation result for bone sample.

IV. CONCLUSION

In this research, detailed analysis of the influences of temperature concentration of bone drilling has been conducted by experimental investigation on drill bit on bone sample. The following conclusions are listed below.

- The drill bit sample was developed by grinding helix section of drill bit by grinding wheel for development of different optimized drill bit.
- Temperature distribution is the fundamental parameter in the performance of drilling of bone sample.
- In the study, the helix angle for drilling of bone sample is investigated for resistibility against temperature concentration at 3000 RPM.

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