A COMPARATIVE STUDY BETWEEN CONVENTIONAL DRILLING AND HELICAL MILLING IN HOLE MAKING IN TITANIUM ALLOYS FOR MEDICAL APPLICATIONS

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1 INTRODUCTION

Hole making in medical devices is a common finishing manufacturing operation. Hence the need to refine and develop methods that allow to make them more efficiently and with the desired quality, so that the function to be performed is not compromised, it is necessary to adjust the manufacturing method. Compared to conventional drilling, helical milling offers the economic advantage of being able to drill holes of different diameters with the same tool [1]. Some previous studies revelated the required cutting forces are considerably lower than those of drilling, there is a lower generation of high temperatures and a lower probability of occurrence of adhesion of the material to the tool. This results presents a clear advantages of this milling in terms of tool life and less burr both at the entrance and at the exit of the hole, which removes the need for finishing operation such as reaming or countersinking [2], [3].The objective of this work is to be able to compare the quality of surfaces in terms of Ra, Rt and Rz (DIN) generated by drilling and helical milling in two titanium alloys in a series of tests with different cutting parameters.

2 EXPERIMENTAL WORK

Materials

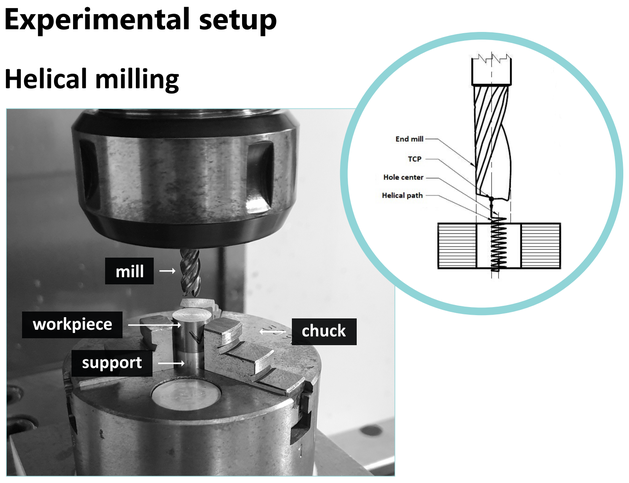
Material	UTS [MPa]	0.2% YS [MPa]	Elong. [%]	E [GPa]
Ti-6Al-4V	895 - 1110	828 - 970	6 - 18	110
Ti-6Al-7Nb	900 - 1021	800 - 910	10 - 15	105

Equipment

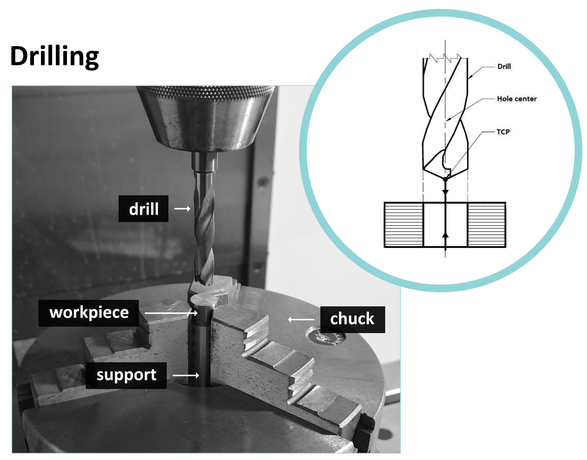
- Mikron VCE 500 (machining center)
- Hommel Tester T1000 (roughness tester)

Experimental setup

Helical milling



Drilling



Helical milling test parameters

Test (N.)	Vc (m/min.)	Vf (mm/min.)	ap (mm)	T (s)
1	100	318	0.04	444
2	100	318	0.08	222
3	100	318	0.12	148
4	100	637	0.04	222
5	100	637	0.08	111
6	100	637	0.12	74
7	100	955	0.04	148
8	100	955	0.08	74
9	100	955	0.12	49

Drilling test parameters

Test (N.)	Vc (m/min.)	Vf (mm/min.)	T (s)
1	50	375	231
2	50	562	154
3	50	749	115

3 RESULTS

HM : Helical milling tests
D: Drilling tests

4 CONCLUSION

In this work several tests were conducted so that it could be possible to evaluate and compare two different hole making methods, helical milling and drilling applied to two different Ti alloys used in medical devices manufacturing. Although the roughness values obtained in helical milling are close to those obtained by drilling, taking into account all the other factors mentioned in this work, the helical milling presents itself as a better option in hole making. The Ti-6Al-7Nb presents better roughness values than Ti-6Al-4V alloy in same tests conditions.

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