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Fatigue Failure in Different Types of Ni-Ti Alloy

Pranav Ratnaparkhi[1], AJ. Patil[2], Pankaj Raut[3]

[1]student of mechanical department, SKNCOE, Pune

Email id – pranavratnaparkhi27@gmail.com

ABSTRACT

Nickel titanium alloy are used are used endodontic treatment fo rmore than two decades . NiTi alloy offers superior flexibility due to occurance of austenite and martensite transformation.The Niti alloy are genrally used in root-canals treatment.A nickel-based super alloy is to manufacture aeroengine component. At high tempreture ni based superalloy show fatigue crack propagation. In fatigue damage in the plastic zone can also be a factor to explain the overload retardation.The magenisum alloy are widely used in astronotial and automotive industry because they have high specific strength and excellent damping properties.under different strain amplitude and strain rate they show fatigue behavior.In Transportation system also fatigue failure is occurred.

Keywords*:* ***ni-ti alloy ,root canal.***

1.INTRODUCTION

Fatigue of nickel-titanium, engine-driven instruments was studied by determining the effect of canal curvature and operating speed on the breakage of Light speed instruments. A new method of canal curvature evaluation that addressed both angle and abruptness of curvature was introduced. Canal curvature was simulated by constructing six curved stainless-steel guide tubes with angles of curvature of 30, 45, or 60 angles. and radii of curvature of 2 or 5 mm. Size #30 and #40 Light speed instruments were placed through the guide tubes and the heads secured in the collet of a Magtrol Dynamometer. A simulated operating load of 10 -cm was applied. Instruments wewere not affected by rpm. Instruments did not separate at the head, but rather at the point of maximum flexure of the shaft, corresponding to the midpoint of curvature within the guide tube. The instruments with larger diameter shafts, #40, failed after significantly fewer cycles than did #30 instruments under identical test conditions. Multivariable analysis of variance indicated that cycles to failure significantly decreased as the radius of curvature decreased from 5 mm to 2 mm and as the angle of curvature increased greater than 30 degrees ($p < 0.05$, power =re able to rotate freely in the test apparatus at speeds of 750,1300, or 2000 rpm until separation occurred. Cycles to failure were determined. In Ni based superalloy experimental fatigue propagation rate(FPCR) data da/dN (a a is the crak length and N the loading cyles) and driving force ,characterized by stress inversely fator K,such as D(k),K MAX etc.

2. METHOD

a) We have to carried a single step fatigue test where carried out to asscess the performance of two bathes are pro-taper and and profile with radius 5mm,7.5mm,10mm and insertion angle 20,40,60 we have to select angle in the combination as (20,40),(20,60) (40,20),(60,20) and fracture surface is carried out by sanning electron a microsopy.

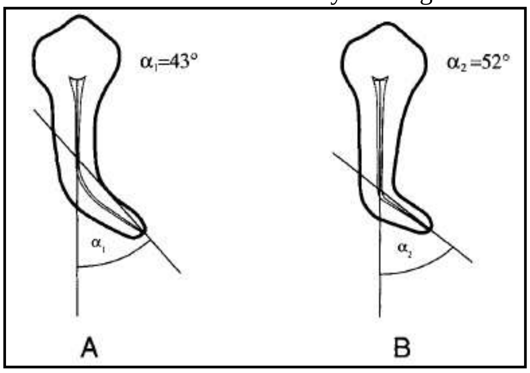

Fig-1. Degree of root canal curvature.

b) The method described by Schneider for determining canal curvature uses only one parameterto define the angle. Tt =, two simulated teeth demonstrate how a difference in abruptne of the curve (radius of curvature) will vary the degree of curvature as measured by this method.A has an angle of 43 degrees and B has an angle of 52 degrees, even though both angles measured according to our method equaled 60 de This study required defining the parameters of canal curvature in a more exact manner than generally used in endodontic research. Canal curvature is usually depicted by a single parameter, anarbitrary angle measured in degrees as described by Schneider To determine the degree of root curvature, he scribed a line parallel to the long axis of the canal. A second line was drawn from the apical foramen to intersect with the first line at the point where in the canal began to leave the long axis of the canal. The acute angle formed was defined as the degree of root curvature.

4.MATERIAL AND METHOD

The radius of curvature (r I and r 2) is the length of the radius of the circle measured in millimeters. The radius of curvature represents how abruptly or severely a specific angle of curvature occurs as the canal deviates from a straight line. The smaller the radius of curvature, the more abrupt the canal deviation. The parameters of angle of curvature and radius of curvature are independent of each other. Canals can have the same angle of curvature while having different radii of curvature, resulting in more abrupt curves. Because controlled cyclic fatigue studies on Ni-Ti, enginedriven endodontic instruments had not previously been performed, pilot studies were required to develop a test apparatus and specify the test parameters. The parameters of radius of curvature and angle of curvature needed to be defined narrowly enough to allow accurate data collection. Extracted teeth with severe root curvatures suggesting possible high-stress conditions leading to instrument separation were radio graphed. Radiographs were also made of teeth treated clinically in which separation of Ni-Ti Light speed instruments had occurred. The radius of curvature of the canals in these teeth was determined by using a circle gauge aligned over the image of the canal profile. Additionally, size #30 Lightspeed instruments were operated through bent needles simulating increasing canal curvatures. Instruments tested in canals having a 5-mm radius of curvature with an angle of curvature of 30 degrees separated as a result of cyclic fatigue. Stress levels induced by lesser curvatures did not result in instrument separation (occurring in over 30 min at a speed of 2000 rpm) within the time frame for the test apparatus or data collection. Thus, angles of curvature of 30, 45, and 60 degrees.

5. MICROSTRUTRE

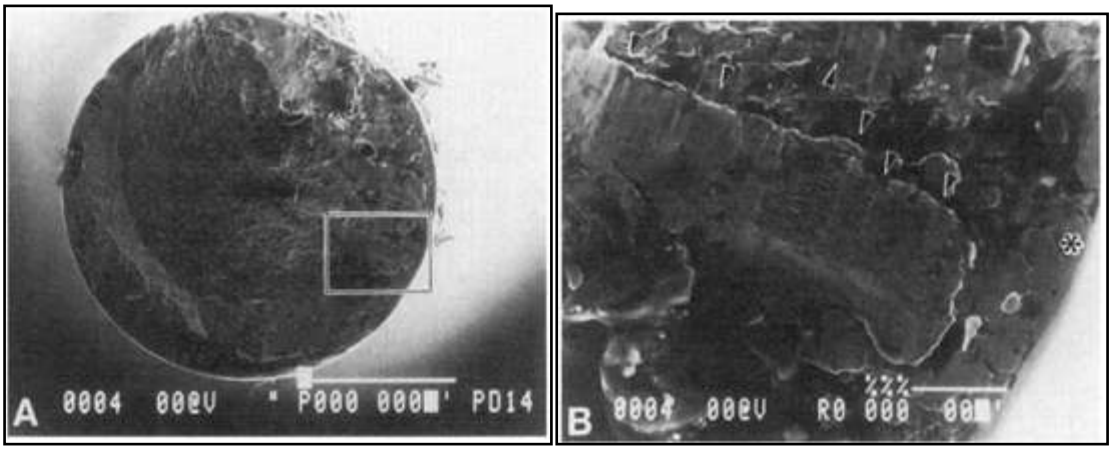

Fig.(A)(B).Stages of instrument fracture.

A. Stages of instrument fracture. A shows the fracture surface of a size #30 instrument at ×300 original magnification. The boxed area is enlarged in B having a x1900 original magnification. The asterisk indicates the area of crack initiation on the periphery. Crack propagation is seen in B as striations marked by the arrows. Each striation represents a "jump" in the fracture surface that occurred under tension in that area during rotation.

6. ACKNOWLEDGMENT

This is the first comprehensive study of cyclic fatigue that incorporates canal geometry as a factor in the breakage of Ni-Ti rotary instruments. All instruments were allowed to rotate freelyunder a 10 g-cm torsional load through artificial curved canals untilseparation occurred. Instruments were not statically loaded until failure instrument separation did not occur because of static torsional overloading. The results indicate that cyclic fatigue is an important factor in the separation of Ni-Ti rotary instruments used clinically, and that specific measurable parameters tool geometry. merit size exist, which significantly reduce instrument cyclic fa-tigue life. There is a clear need for the development of a test protocol for the cyclic fatigue of Ni-Ti, in studies on stainless- steel rotary instruments, have also advocated the development of a cyclic fatigue test protocol that simulates clinical conditions of instrument use. . A significantdifference was found between conventional stainless-steel files and all Ni-Ti file groups. It was also noted that in rotation-to-breakage studies of Ni-Ti files that allowed free tip rotation, the range of results within each same-size group was large and unpredictable. That preliminary information on rotation-to-breakage of hand instruments stated that the instruments were rotated in a 90-degree metal tube until they broke. Defining the test parameters in such a limited manner, without strictly controlling the variables of curve geometry, may explain the variability in rotation-to-breakage (cycles to failure) results and the conclusion drawn concerning Ni-Ti instruments.

7. REFERENCES

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