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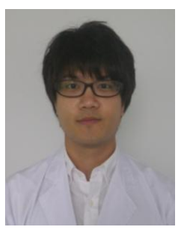

Comparison of strength titanium and titanium alloy implant

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GC CORPORATION

http://www.gcdental.co.jp/implant/
http://www.gctech-europe.com/

Topic: Basic research

Background and Aim

In implant treatment, implant fracture is one of the serious problems. It is considered to be one countermeasure to adopt Ti-6Al-4Vfor the implant materials. As shown in Fig.1 Ti-6Al-4V is superior to pure titanium (Grade 4) in mechanical properties.

However, it is not clarified if Ti-6Al-4V implant is really effective to prevent the implant fracture in actual clinical situations. Because, in fact, implants function in combination with abutments and abutment screws.

The aim of this study is to compare the strength in combination with abutments and abutment screws between pure titanium and Ti-6Al-4V implants with the same design, to confirm effectivity of Ti-6Al-4V implants.

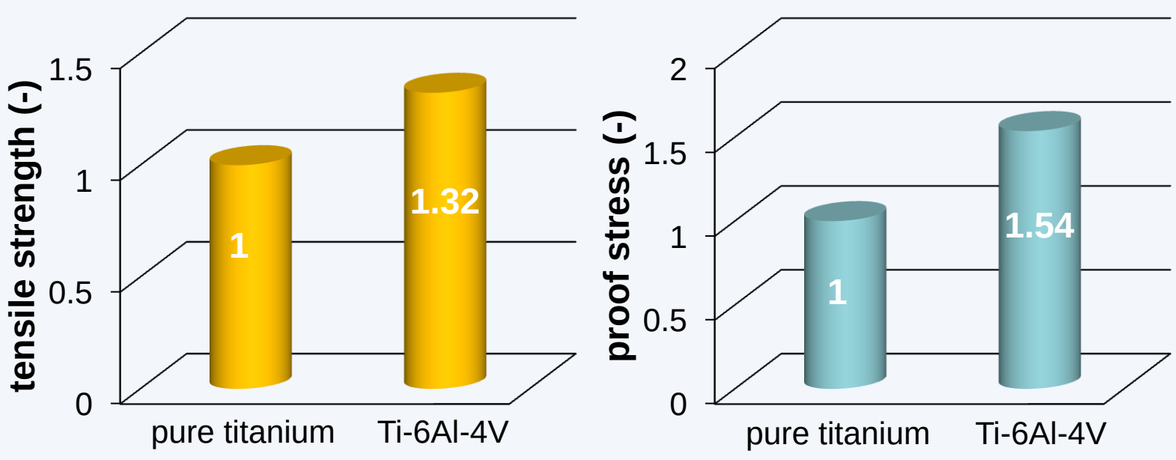


Fig.1 Difference of mechanical property of Ti-6Al-4V relative to pure titanium

Methods and Materials

1. Materials and test models

Two types of implants with the same design were used for this study: Aadva Standard Implant ϕ4.0 x 8mm(Ti-6Al-4V, GC Corporation), and the implant which is same design with Aadva Standard Implant ϕ4.0 x 8mm(pure titanium Grade 4). Abutments(Ti-6Al-4V) were connected to these implants with abutment screws (Ti-6Al-4V) at 20 N･cm(Fig.2).

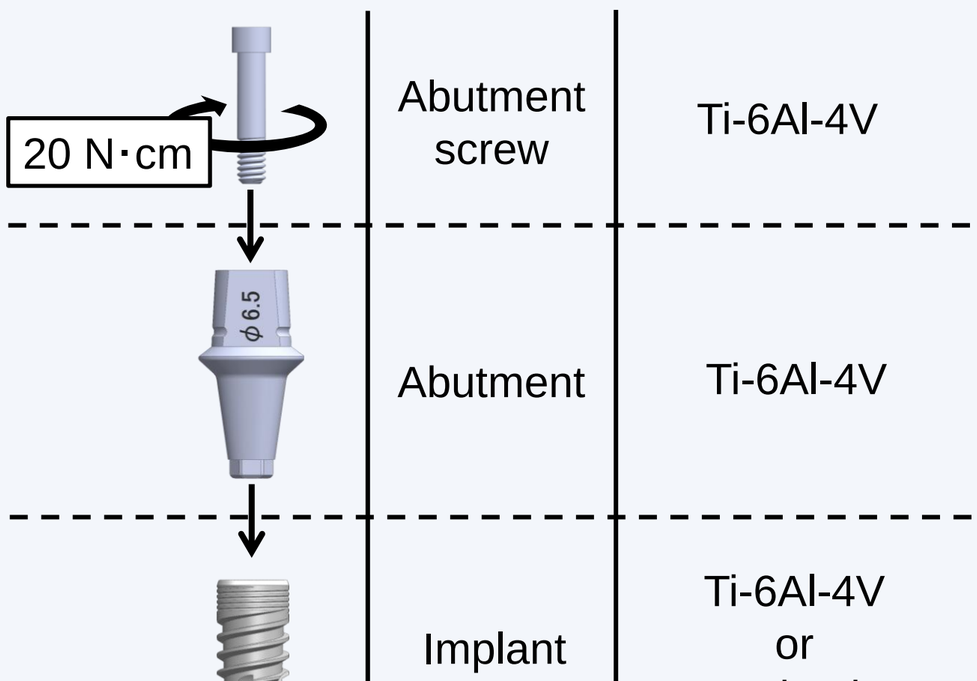


Fig.2 Test models

2. Static bending test

Loading geometry was set in accordance with ISO 14801(Fig.3), static bending test was carried out by loading machine (AG-IS, SHIMADZU Co.). Test speed was 1mm/min. The load at which plastic deformation started was identified from the graph of these test results. In addition, deformation angle (α of Fig.4) of each sample was measured.(n=3)

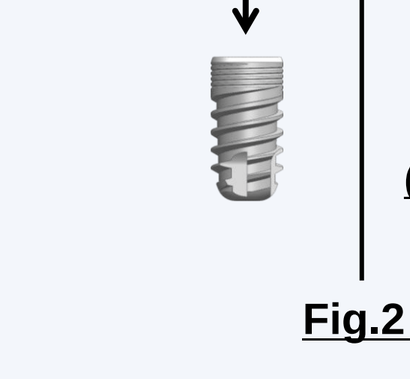


Fig.3 Loading geometry

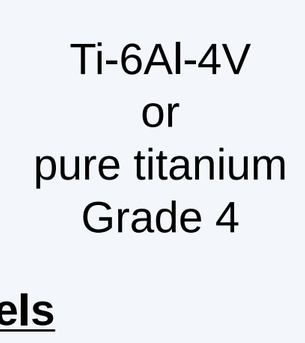


Fig.4 Deformation angle

3. Definition of the plastic deformation load

As a result of static bending test, the graphs were obtained like black curve in Fig.5. The load of flexion point was defined as plastic deformation load.

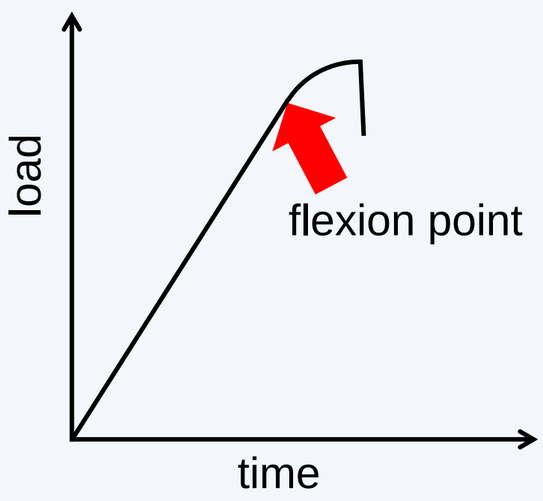


Fig.5 Schema of graph

Results

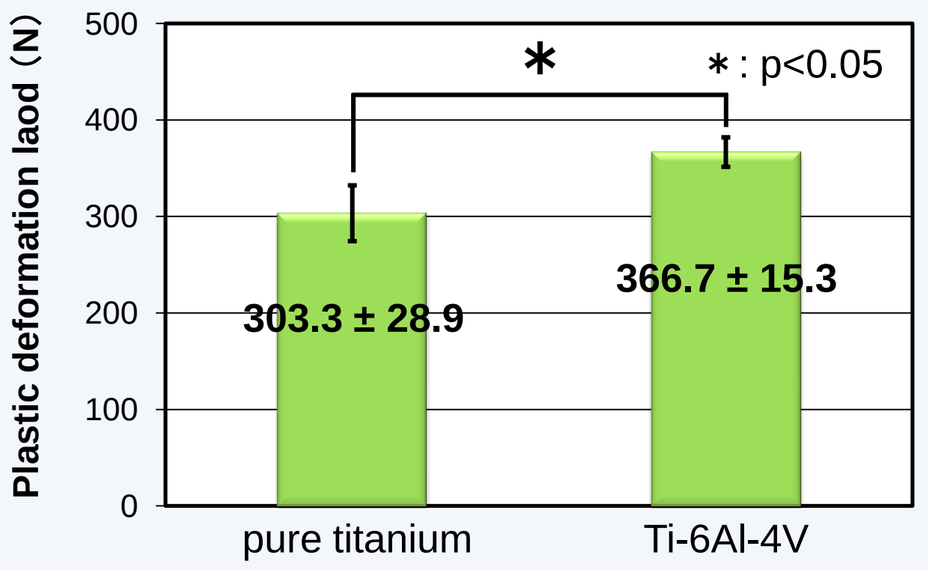


Fig.6 Plastic deformation load

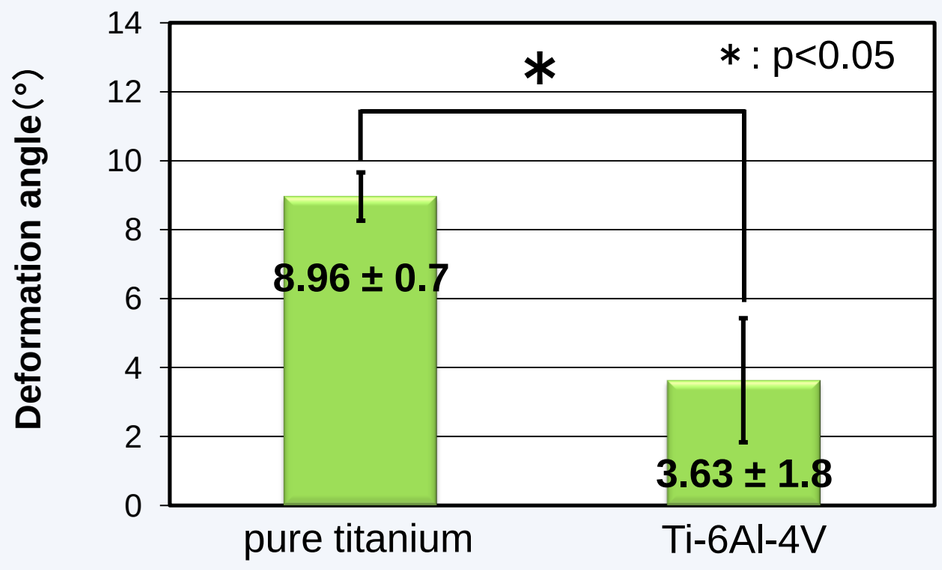


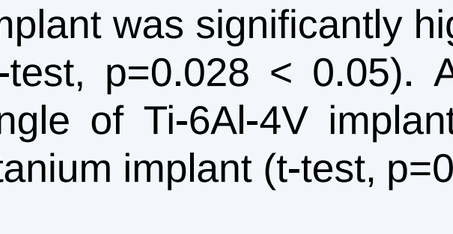
Fig.7 Deformation angle

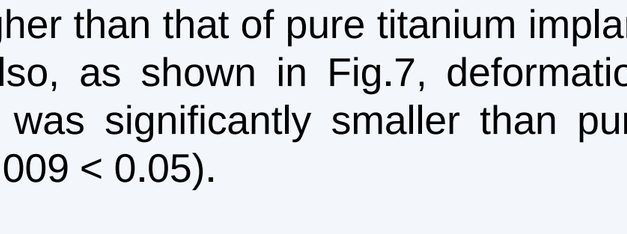
As shown in Fig.6. The plastic deformation load of Ti-6Al-4V implant was significantly higher than that of pure titanium implant (t-test, $p=0.028 < 0.05$). Also, as shown in Fig.7, deformation angle of Ti-6Al-4V implant was significantly smaller than pure titanium implant (t-test, $p=0.009 < 0.05$).

These results suggested that Ti-6Al-4V implants have a better mechanical property compared to pure titanium even when those are used in combination with abutments and abutment screws.

Conclusions

As a result of this study, it was suggested that adopting of Ti-6Al-4V for implant materials is rational to avoid fracture. However, only the influence of static load was examined in this study, while implants in actual clinical situations are applied load repeatedly. Further study is needed to fully clarify the effectivity of titanium alloy as implant material.





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