THE EFFECT OF REMOVING BLOOD AND BONE OIL ON THE MECHANICAL STRENGTH OF CEMENT-BONE INTERAFACE

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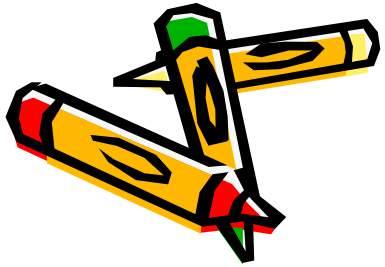
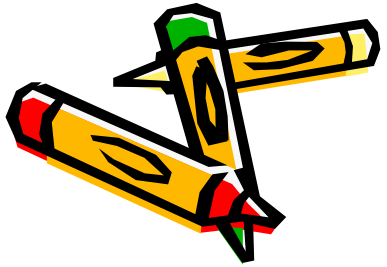


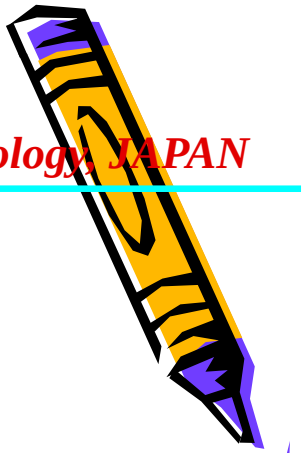
INTRODUCTION

In cemented total joint replacement, failure of the cement-bone interface is often associated with loosening. We hypothesized that removal of blood and bone oil improves the mechanical strength of the cement-bone interface.

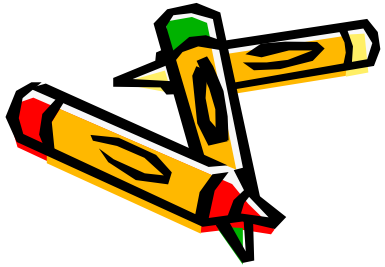
In this study, using cancellous bone, we compared the mechanical shear strength of cement- bone interface with and without blood and bone oil.



METHODS



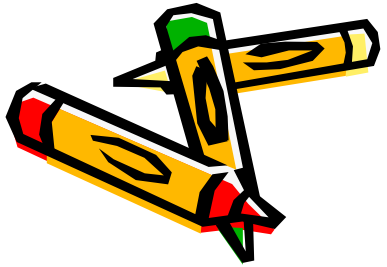
6 pairs of ox tibiae were used. Each proximal tibia was osteotomized 20mm below the medial plateau, and vertical holes (7.5 mm diameter) were drilled in the tibiae. Each cut surface was washed using palsatile lavage to clean out bone debris.



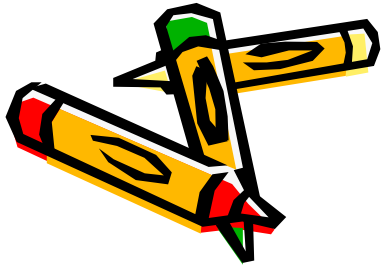
METHODS

Two cases of experiment were carried out to investigate each influence of blood and bone oil.

(1) To examine the influence of remaining blood, one side of the 3 pairs of tibiae was soaked in a fresh human blood to simulate bleeding from the bone (*BLOOD*+), and the other side was left as it is (*BLOOD*-).

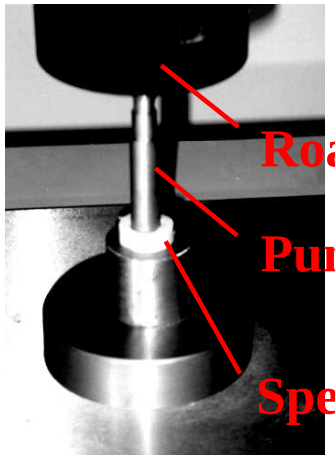


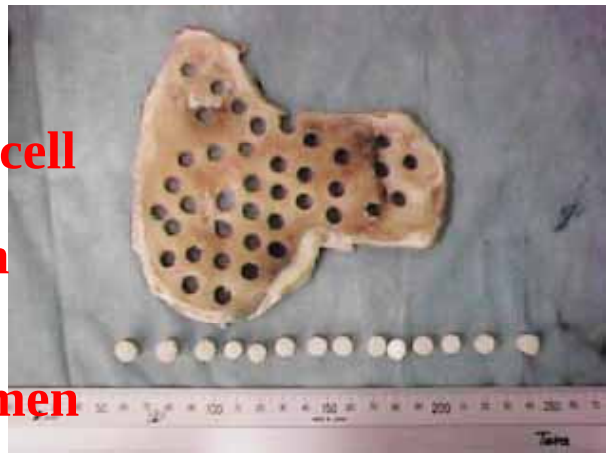
(2) Likewise, to learn the effect of removing bone oil, one side of the 3 pairs tibiae was cleaned using 1 percent surfactant that is used as an emulsifier in the food (*OIL*-), and the other side, using saline solution (*OIL*+).



METHODS

Doughy cement (Simplex P) was injected into each hole using a caliber syringe under pressure. Then, 3 cross sections of 10 mm thickness were sliced off from the proximal tibiae, and each cylindrical cement buried in the bone plates was pushed-out by Instron mechanical test machine.



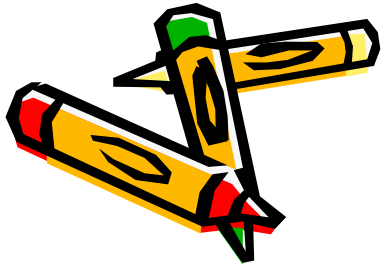


METHODS

The maximum load at failure was converted to an interface shear stress (ISS).

(1) 103 and 117 pieces of cylindrical cement were pushed to test the effect of blood removal, as the groups of *BLOOD*+ and *BLOOD*-, respectively.

(2) Likewise, 139 and 121 pieces of cement were used to test the effect of oil removal using surfactant, as *OIL*- and *OIL*+.



RESULTS

The ISS (means ± 1 S.D.) of *BLOOD*+ and *BLOOD*- were 2.3(1.1) MPa and 2.7(1.3).

The ISS of *BLOOD*- shows an increase of 18% as compared with *BLOOD*+. Significant differences were found (p<0.01, Student's t-test).

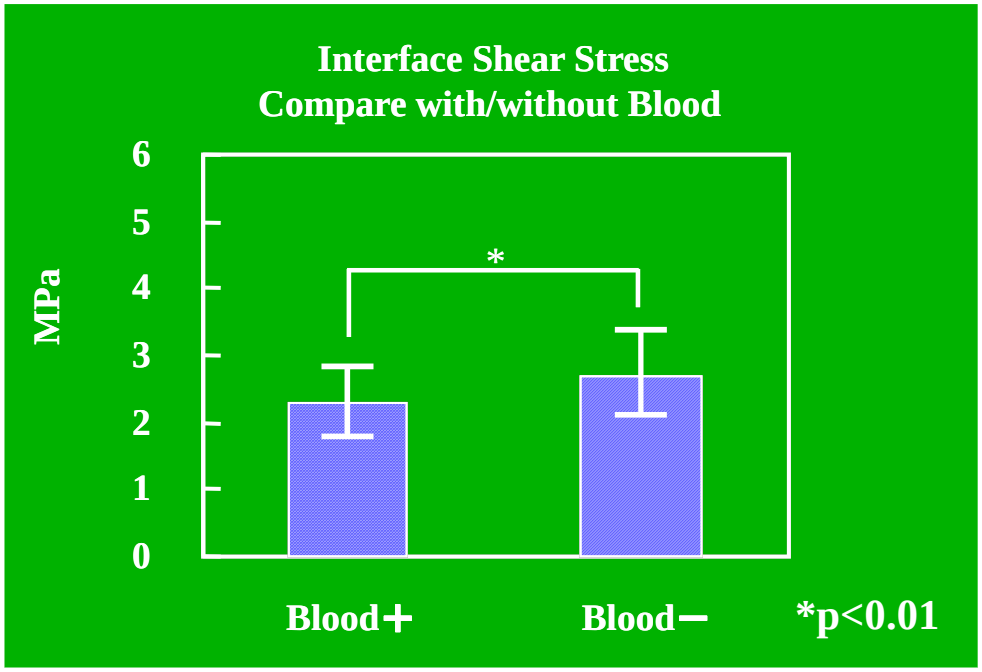


Figure 1

RESULTS

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Fig. 2 shows the results of *OIL*+ and *OIL*-. The ISS of *OIL*+ was 2.6(1.5) MPa, and *OIL*- was 3.8(1.9).

The ISS of *OIL*- shows an increase of 46% as compared with *OIL*+. Significant differences were found (p<0.0001, Student's t-tset).

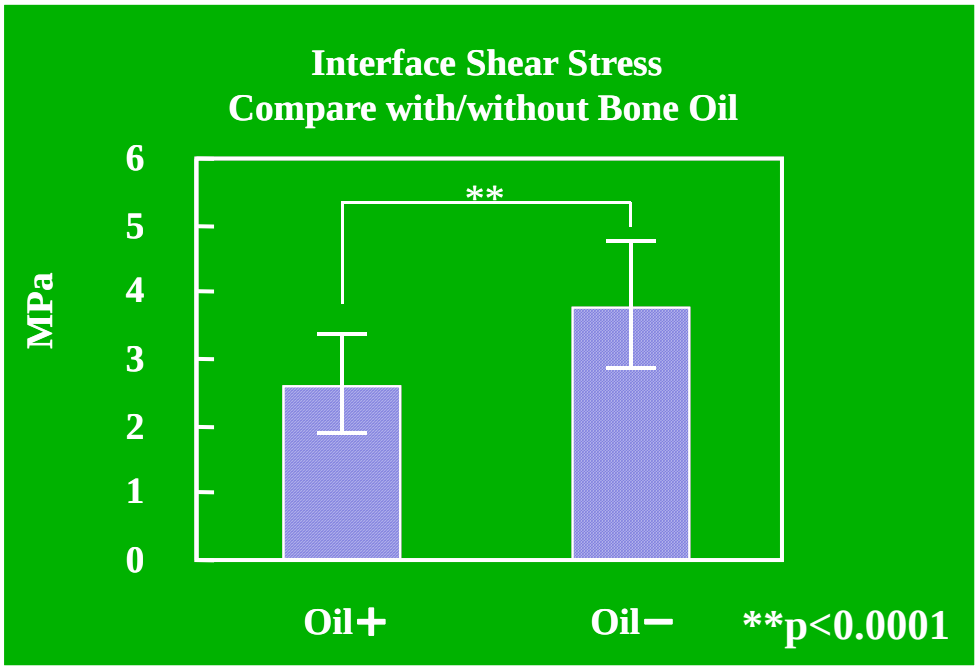
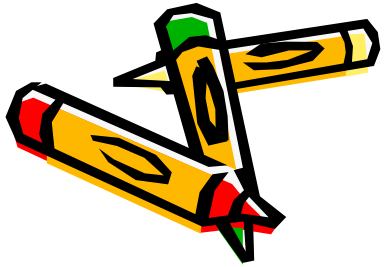
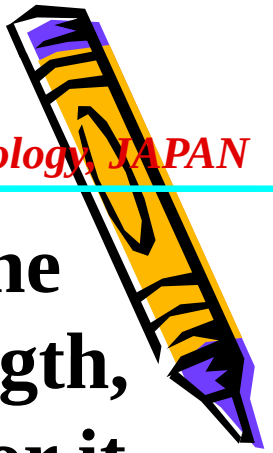


Figure 2

Removal of blood and bone oil remarkably increased the mechanical strength probably through the improvement of microlock between cement and bone by the removal of the interposing material. Some papers described that cleaning out blood and bone debris on the bone surface gives satisfactory strength.

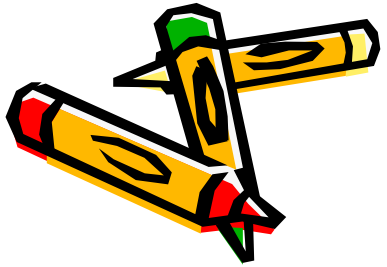


DISCUSSION & CONCLUSION



However, other authors suggest that bone oil membrane decreases the mechanical strength, more than other factors. One of the reasons for it will be that bone oil on the surface will not be removed completely, even by applying the palsatile lavage system using only saline solution.

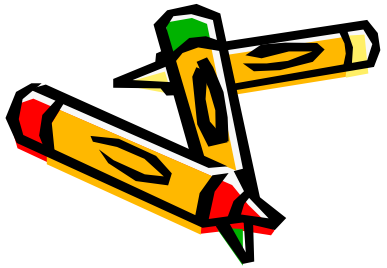
Thus, we came to a conclusion that removal of blood and bone oil within the bone is essential to the improvement of the fixation, and that non-invasive technique to remove bone oil is needed.



DISCUSSION & CONCLUSION

In this study, we use glycerol esters of fatty acid (*GEFA*) as surfactant. Since *GEFA* is used widely as emulsifier in the food and cosmetics, we regard *GEFA* does not have toxic.

In another technique, we think glycerin monolaurate (*GML*) is effective to remove oil. *GML* is a surfactant that has been found out to inhibit the post-exponential phase activation of virulence factor production and the induction of beta-lactamase in Staphylococcus, and many papers describe *GEFA*'s nontoxic.



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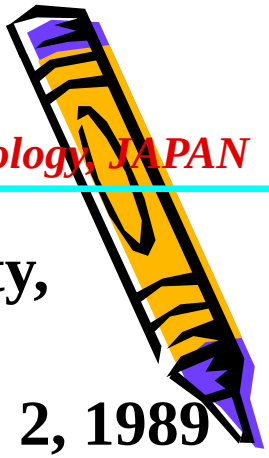

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