At, on and below the surface

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WG Evans

Featuring at the Rugby World Cup are the variety of mouthguards… off-beat designs, some have left/right side different colours, some even appear to include images of frightening teeth… but the most critical factor is their constant presence... a conscientious use.

An outstanding example to every rugby player and enthusiast. In 2014, an Australian study reported that the prevalence of orofacial injury amongst rugby union players was 65%, and the most common injury was laceration to soft tissues in and around the mouth.[1]

Dental injuries occurred in 42% of the cases, with tooth loss being suffered in 35% of the instances. In New Zealand, referees have been granted the power of ensuring that every player must wear a mouthguard... and there has been a 43% reduction in dental injuries.[2]

South African World Cup players are wearing specially designed mouthguards which not only offer the desired protection but are also equipped with sensors which record the impact sustained when there is a clash of hard surfaces… heads with heads or heads with elbows or boot and heads… or indeed, heads against the hard surface of the field!

Any player who suffers such an impact and is then referred off the field for assessment may now be monitored and the extent of the impact determined, enabling better judgement on whether the player may returned to action, or more wisely, sent for further medical attention. These technological advances may make a significant contribution to the safety of players... and not only in rugby. An average impact has been measured at 20 to 30 equivalents of gravitational force (Gs) and a particularly hard impact at 40 Gs. Those impacts occur in Football, Hockey, Ice Hockey... the list continues.

The development of the special mouthguards has been conducted in the United Kingdom, with collaboration between Sports and Wellbeing Analytics, Keytree and Swansea University and initial testing was carried out by the Welsh team, the Ospreys.[3]

It may seem a massive jump from the turmoil of rugby to the tranquil pages of this issue... but lets look at the major content, a comprehensive survey of the research work aimed at unravelling some of the intricacies of the growth of bone. The investigations have revealed an intriguing situation… namely that the shape of surfaces … the nano or minute… shape may have an influence on stimulating the process of osteogenesis.

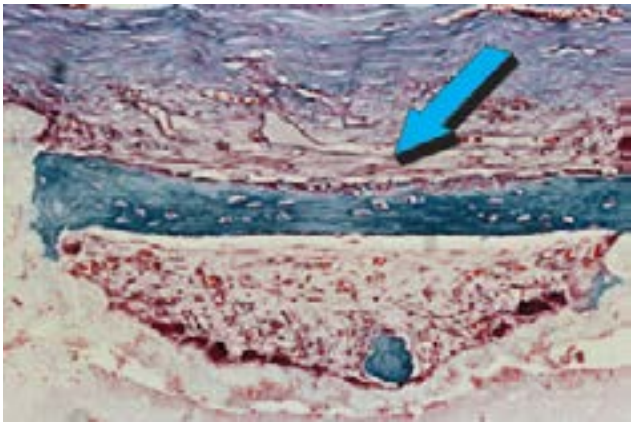

Figure 14 C. (From: Article 1 - Inductive surface' geometries: Beyond morphogens and stem cells)
Collagenous condensations (dark blue arrows) stretching across a concavity of a hydroxyapatite-coated titanium implant 5 days after implantation in the *rectus abdominis* muscle of the non-human primate *Papio ursinus*. The scanning electron macroscopy (SEM) image depicts tractional patterning forces of fibroblastic/myofibroblastic-like cells secreting collagen fibres whilst moving from the edges of the concavities across the concavities of the hydroxyapatite-coated substratum.
(**C**) Transformation of collagenous condensation across concavities into bone matrix 90 days after heterotopic implantation in the *rectus abdominis* muscle of the non-human primate *Papio ursinus*.
(**C**) Decalcified sections cut at 6 µm stained with toluidine blue in 30% ethanol. Original magnification (**B**,**C**) x37.

A plane surface appears to have no or little influence but miniscule variations of the surface result in cellular modifications and cellular activities.

These relevations may have long reaching influences, for they may point the way towards our ability to stimulate or to initiate bone growth... as for example a mandibular fracture sustained in rugby! There remains much to be done... for the results are those determined in animal studies... and have not proven repeatable in humans... as yet!

Are we simply scratching the surface of what may be a momentous discovery... the ability to call at will on bone... and possibly other tissues? Whatever the future, it is most warranted that we look beneath the surface and consider the paper in depth, bringing us up to date with seminal research efforts.

References

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2. the natural smile.co.uk. rugby-world-cup-the-importance-of-mouth-guards/.
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WG Evans: Managing editor, Email: bill.evans@wits.ac.za