

Comparative morphological study of bone regeneration in different rabbit cranial osteotomies: traditional versus new generation osteotomes

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The aim of this study was to compare the bone regeneration after skull surgery by means of different recent osteotomy devices, piezosurgery medical (PM) and piezosurgery medical plus (PMP), versus a conventional rotary osteotomy device (OT) in 16 adult white New Zealand rabbits. After 14 days from surgery, the recovery of different resulting bone gaps were observed under structural and TEM-ultrastructural analyses. Our preliminary observations showed that the minimum distance from the osteotomy edge, at which it is possible to observe viable osteocytes in the pre-existent bone, was lower in PMP samples (average 38.2 μ m) with respect to PM (65.7 μ m) and OT (83.4 μ m) ones. Moreover, the size of osteotomy gap performed with OT was about twice in thickness with respect to those obtained by PM and PMP. In relation to our previous investigations (1) on two different types of bone formation occurring in sequence (static and dynamic osteogenesis), we observed in the present study that in PM and PMP samples the osteotomy gap is in a more advanced step of recovery with respect to OT ones: in OT samples numerous cords of stationary osteoblasts, forming preliminary bony trabeculae, were observed in the regenerating newly-formed bone (step of static osteogenesis); whereas, in PM and PMP samples bony trabeculae appeared mostly covered by typical prismatic osteoblasts, arranged in movable laminae (advanced step of dynamic osteogenesis). By histomorphometry, in PM and PMP samples with respect to OT ones: i) values of the regenerated bone area with respect to the total osteotomy area (BV/TV%) are about twice; ii) the number of TRAP positive osteoclasts per linear surface showed a significant increase, suggesting higher bone remodelling. Concerning SEM analysis, in all samples the regenerated bone displays, as expected, higher cell density and less mineralized matrix with respect to the pre-existent bone, independently from the device used. In conclusion, our results indicate that osteotomies performed with PM and PMP can be considered equivalent and show more advanced stages of healing compared to OT, in part due to the lower osteotomy thickness in PM and PMP with respect to OT.

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References

- [1] Ferretti et al. (2002) Static and dynamic osteogenesis: two different types of bone formation. *Anat Embryol* 206, 21–29; doi:10.1007/s00429-002-0265-6.

Keywords

Cranial osteotomy; bone regeneration; piezosurgery medical/medical plus.