Tissue Engineering in Mircrotia Reconstruction

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Microtia is a congenital ear deformity that can seriously influence the psychological and physiological problem for children. Ear reconstruction owing to congenital malformation is still a challenge issue for plastic and reconstructive surgery. Total ear reconstruction using an autologous costal cartilage framework placed in a subcutaneous pocket remains the definitive standard procedure for total ear reconstruction.(Brent, 1999; Nagata, 1993) However, this technique has limitations that include a long learning curve, a construction that is inflexible, often lengthy surgery, and donor-site morbidity. Using ear-shaped alloplastic materials such as ear-shaped Medpor (high density porous polyethylene material) is an alternative method for total ear reconstruction. (Yang et al., 2002) Although it saves time dramatically without donor site morbidity, the implant sometimes will have complications such as extrusion due to minor trauma.

Ear-shape cartilage tissue engineering is now a promising research direction for possible improvement of the drawbacks from autogenous rib cartilage and alloplastic materials.(Ray et al., 2010; Sivayoham and Woolford, 2012) The concept is brought by Professor Cao who produced the first human ear on nude mice back by seeding chondrocytes on the ear-shaped PGA/PLA scaffold. (Cao et al., 1997) Since then, numerous strategies of combination of different cell sources, various scaffolds' materials and growth factors for ear tissue engineering has been published in animal study. In this report, the author will give a brief review of advance of tissue engineering in ear reconstruction both in bench study and human clinical trials.

Autologous Mesenchymal Stem Cells for Treatment of Alveolar Cleft

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Cleft lip and palate is the most common congenital craniofacial anomaly. Every year, there are around 300 new births with cleft lip and palate in Taiwan. Involvement of primary palatal fusion will result in cleft lip, alveolar bone cleft and cleft of small part of palatal bone. Cleft lip repair now is a very standard procedure with aesthetic outcome at 3 month old infant in Chang Gung Memorial Hospital. However, the alveolar cleft repair still is controversial in surgical timing, methods and the unpredictable outcomes. The primary aim of alveolar bone reconstruction is to restore the continuity of maxillary alveolar arch to support the eruption of permanent canine teeth, prevent from the retrusion of midface, have normal articulation of phonation and sustain normal occlusion. There are two surgical methods for alveolar bone defect reconstruction: (1) secondary gingivoperiosteoplasty (SGGP) which is performed at mixed dentition 7-11 year-old (2) Secondary alveolar bone grafting (SABG) which is also performed at 7-11 year-old child of mix-dentition age. The advantage of secondary gingivoperiosteoplasty (SGGP) is to restore the alveolar bone defect by guided bone regeneration which can avoid the donor site morbidity derived from bone grafting harvest surgery. However, the result is not constant at each institution. The secondary alveolar bone grafting at mix-dentition age though produces are more constant result of bone defect reconstruction, the disadvantages are the additional harvest surgery, donor site morbidity and unpredictable graft absorption. In previous comparison between these two techniques at our institute, the outcome showed only 50% and 80% success at SGGP and SABG group, respectively. By the advance of tissue engineering concepts, the combination of cells, scaffolds and growth factors in craniofacial reconstruction has been published in literatures with successful reconstruction both in animal study and some clinical trials.

In this report, the author will give a brief review of craniofacial bone tissue engineering in recent bench and animal study and how to apply stem cell-based tissue engineering in alveolar defect regeneration.