

Collagenase Digestion of Human Dentin Block and Vertical Augmentation by Demineralized Dentin Matrix Block on Skull without Periosteum of Adult Rats

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Aim

The aims of this study were to digest human dentin blocks by collagenase and evaluate a graft of partially demineralized dentin matrix (PDDM) block on 10 month-old adult Wistar rat skull without periosteum as vertical augmentation model.

Materials and Methods

<Preparation of dentin blocks>

- *Human molar root sliced into disks (Fig.1).
- ***Ultrasonic demineralization** in 1.0L of 2% HNO₃ for 30 min (Fig.2, 3).
- *Cut the dentin disk into a block (2x2x1mm³) by blade (Fig.4, 5).



Fig.1



Fig.2



Fig.3



Fig.4



Fig.5

<Collagenase digestion>

- *Enzyme: Collagenase type 2 (Wothington Biochemical Corporation) (Fig.6)
- *Collagenase solution: 40 ml of collagenase solution (0.375mg/ml D.W) (Fig.7)
- *Rotary shaker (Ecan Shaken mixer SHK-2000) at a speed of 4 rpm for 3, 6, 12 weeks (each number = 4, Size: 2x2x1mm³) (Fig.8)



Fig.6



Fig.7



Fig.8

<Animal and graft site>

Skull without periosteum of 10 month-old Wistar rat (Adult-Old stage)



Removal of periosteum

G1: On exposed skull without periosteum

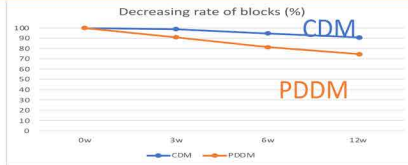
G2: On exposed skull **scratched** by ultrasonic scaler tip for 1 min without periosteum



Scratching

Results

<Collagenase digestion>

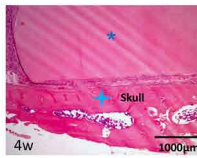
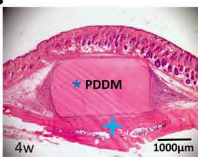


The decreasing rate of CDM and PDDM were 9.2% and 25.5% at 12 weeks, respectively.

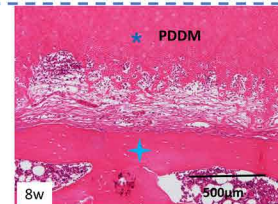
< Augmentation study>

Skull without periosteum (Group 1)

- * PDDM
- + Skull



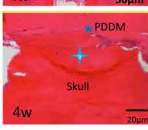
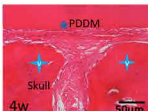
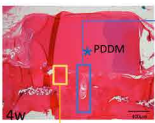
Non marrow-opening at 4 weeks



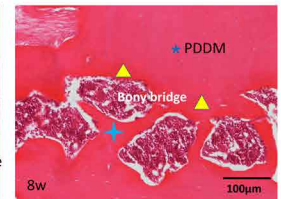
Absorption of PDDM and non-union at 8 weeks

Scratched skull without periosteum (Group 2)

- * PDDM
- + Skull
- ▲ Bony bridge



Marrow-opening at 4 weeks



Bony bridge formation at 8 weeks

Discussion

1. The exposed collagen matrices of PDDM was digested more than CDM by collagenase *in vitro*.
2. Marrow cell-supply and growth factors-release from original bone might be important factors in bone formation between PDDM and highly calcified skull.

Conclusion

1. Human CDM blocked the collagenase digestion.
2. **Partial demineralization** of human dentin block and **ultrasonic scratching** into compact parietal bone of 10 month-old rat could contribute to bony bridge formation between PDDM and dense skull.