Study of Calcification of Teeth by Combination of Heterologous Tissues

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Abstract: We focused attention of the calcification ability of coral cells. A section of coral was transplanted to the cavity of a tooth and observed microscopically for calcification after 7 days (LI group) and 14 days (LII group) of artificial irradiation. Observation after 7 days (NI group) and 14 days (NII group) without artificial irradiation was used as a control. Calcification was observed in the LI and LII groups, while it was not observed in the NI or NII group. The results suggest that coral contains single-cell xanthella which accelerate calcification by photosynthesis.

Key Words: calcification ability; coral cells; photosynthesis; xanthella

Introduction

The hermatypic coral is known for causing calcification by the minerals of seawater. With the recent advances in tissue engineering, its application as a biomaterial for the teeth may be possible in the future (Fig.1,2). In most of the hermatypic corals, the speed of calcification varies according to changes in the environment. In the present study, we chronologically compared the calcification at early stage by means of artificial light irradiation.

Materials and Method

In this experiment, we used the coral of *acropora tumida* as a hermatypic coral (Fig.3).

A section was transplanted into the cavity of a tooth to observe the condition of calcification with a microscope on day 7 (LI group) and day 14 (LII group) after irradiating artificial light (Super Cool®) for 8 hours/day.

The controls were assigned to day 7 (NI group) and day 14 (NII group) after irradiating without artificial light on the transplant for 8 hours/day (Fig 4).

Results

In the LI group, minimal calcification of the transplant was observed.

In the LII group, calcification of the transplant was observed.

In both of the CL-I and CL-II groups, no calcification of the transplant was observed (Fig.4,5).

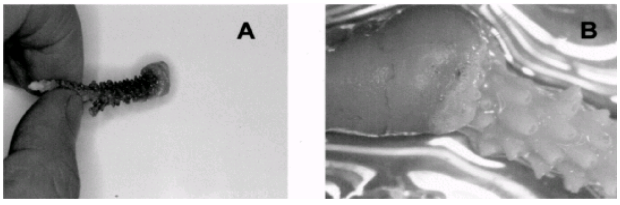

Fig.1-A. It is alive.
Fig.1-B. Adhesion with a tooth (the fossilized stage)

Discussion

The hermatypic coral calcifies the skeleton, in which miniature polyps live. In spite of being animals, these hermatypic corals have single-cell zooxanthella in the body (endosymbiosis). It is considered that the photosynthesis of zooxanthella accelerates calcification of the skeleton. The present study suggested the possibility of earlier calcification of the hermatypic coral via artificial light irradiation.[1-4] With the recent advances in tissue engineering, application of the hermatypic corals in the mouth is expected as biomaterials for the teeth.

Acknowledgments

We were allowed to use a library of AQUARIUM ,Kyoto University (Shirahama-cho) at the time of search of references.

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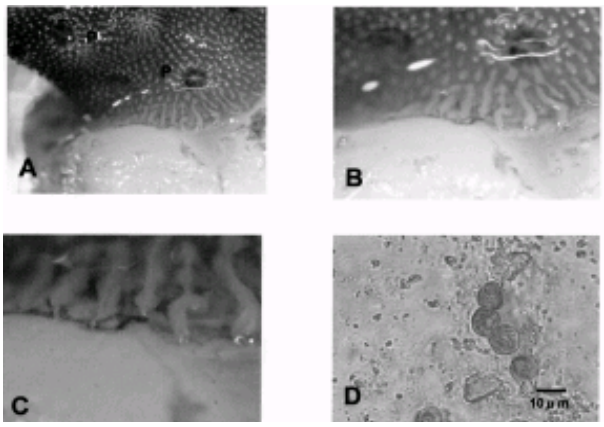

Fig.2-A. P: The polyps are alive.
Fig.2-B. A few umboes expand on the tooth side.
Fig.2-C. Adhesion with a tooth (iIt is alive) (10x.)
Fig.2-D. The single-cell zooxanthella appeared on the tooth.

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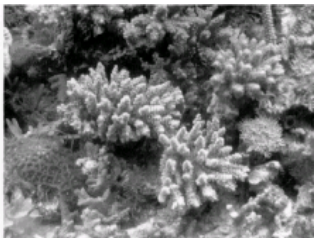

Fig.3. *Acropora tumida* (Center)

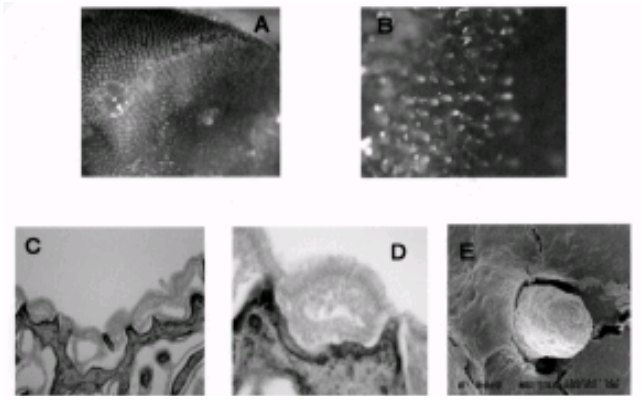

Fig.4-A. Some minimal umboes appeared 1 week after. (LI group)
Fig.4-B. 1 week after (10x.) (LI group)
Fig.4-C. Histological features 1 week after (H&E 10x) (LI group)
Fig.4-D. Histological features 1 week after (H&E 40x.) (LI group)
Fig.4-E. 1 week afte (SEM) (LI group)

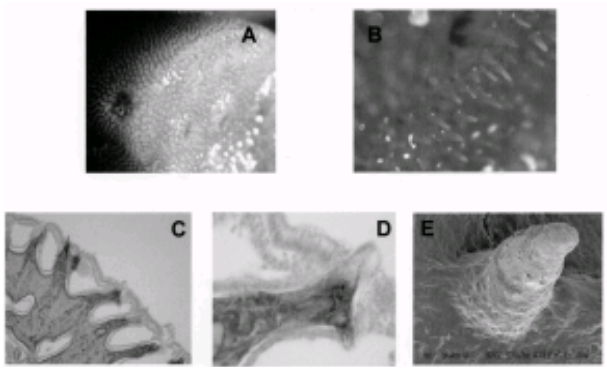

Fig.5-A. Some umboes grew up 2 weeks after. (LII group)
Fig.5-B. 2 weeks after (10x) (LII group)
Fig.5-C. Histological features 2 weeks after (H&E 10x) (LII group)
Fig.5-D. Histological features 2 weeks after (H&E 40x) (LII group)
Fig.5-E. 2 weeks after (SEM) (LII group)