研究者：邱　秀慧（所属：大阪歯科大学 大学院歯学研究科 小児歯科学専攻）

研究題目（Study title）：新規アパタイトアイオノマーセメントの特性に与えるハイドロキシアパタイトの影響に関する基礎的研究

Fundamental study on effects of hydroxyapatite to characteristics of novel apatite ionomer cement

目　的（Objective）：

Glass ionomer cement（GIC）is a unique functional material due to favorable clinical properties, such as chemical bonding, fluoride release and biocompatibility. We have recently developed a novel "apatite-ionomer cement（AIC)" to improve the mechanical and chemical properties of restorative GIC by adding hydroxyapatite（HAp）and reported that AIC had improved mechanical strengths, Fluoride release property and antibacterial property compared with conventional GIC. The aim of this study was to evaluate the several elemental release functions of AIC compared with GIOMER, functional S-PRG filler-containing composite resin which was recently developed and introduced.

材料および方法（Materials and Methods）：

1）Preparation of AIC specimens

Chemically cured GIC for pit and fissure sealing, Fuji III®（GC Corp., Tokyo, Japan), was used as the control group（GIC）and base material of AIC. To produce powder for the pit and fissure sealing material group（AIC), 28 wt% of GIC powder was replaced with a powder composed of spherical HAp（HApS；Taihei Chemical Industrial Co., Ltd., Osaka, Japan）particles using a high-speed dispersion technique, and AIC samples were made by mixing the AIC powder and Fuji III-liquid at P/L 1.2 as recommended by the manufacturer.

2）SEM observation

SEM（SU-70, Hitachi High-Technologies Co., Tokyo, Japan）was used to observe the microstructure of the HApS particles. Moreover, cross-sectional SEM specimens were prepared using a cross-section polisher（SM-09020CP, JEOL）and backscatter electron imaging was performed in a field-emission SEM system（JSM-6701F, JEOL, Tokyo, Japan).

3）Multi-mineral release test

In multi-mineral release test, S-PRG filler-containing resin based sealant BeautiSealant®（SHOFU INC., Kyoto, Japan；Giomer), which is a known functional material, was used as a positive control. Samples were individually suspended by a thread in 18 ml of deionized water for 24 hours at 37°C. For measurements, each disk was removed from the water, and washed with 2 ml of deionized water over the immersed water. Fluoride（F）ion concentration was measured using an ion analyzer（D-53, Horiba Ltd., Kyoto, Japan）and F electrode（6561-10C, Horiba Ltd.). Concentrations of Aluminum（Al), Silicon（Si), phosphate（P), calcium（Ca）and Strontium（Sr）released from the samples were assessed using inductive coupled plasma atomic emission spectroscopy（ICP-AES；ICPS-8100, Shimadzu Co.).

結果および考察（Results and Discussions）：

1）SEM observation

Figure 1 shows a representative image of a HApS particle used in AIC and cross-sectional SEM image of GIC and AIC thin slice samples. HApS particles were spherical and about 20 μm in diameter, and were formed by aggregation of innumerable nano-sized HAp particles. Innumerable nano-particles from the HApS were found to be dispersed within the matrix of AIC, as compared with GIC.

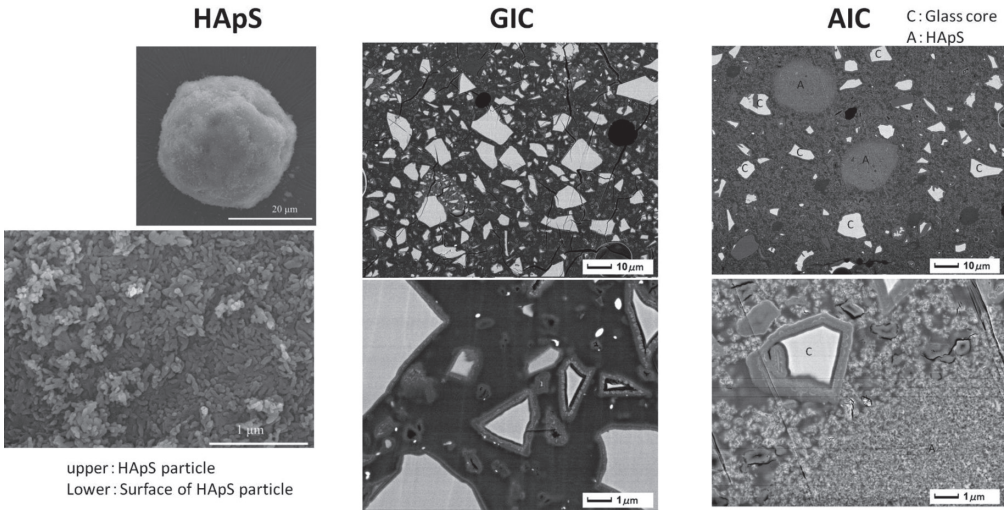

Figure 1. SEM images of HApS, GIC and AIC

2）Multi-mineral release properties

Figure 2 shows the accumulated F ion release doses for GIC, AIC and GIOMER. The accumulated dose of AIC was significant larger than that of GIC and Giomer on all of the experimental days（$p<0.001$）. Moreover, AIC had 1.5-fold and 4.2-fold higher F release dose on the 7 days than that of GIC and Giomer. Figure 3 shows the results of ICP analysis（Al, Si, P, Ca and Sr）for GIC, AIC and Giomer. The release of Si and Ca from AIC was significantly higher when compared with GIC. The release of Al and P from AIC was significantly higher when compared with Giomer.

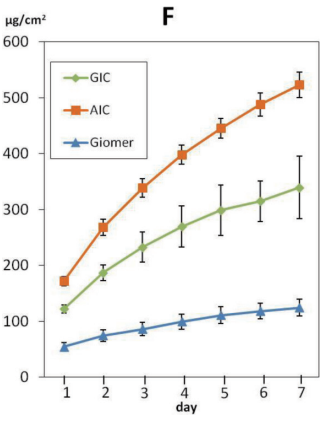

Figure 2. F ion release test

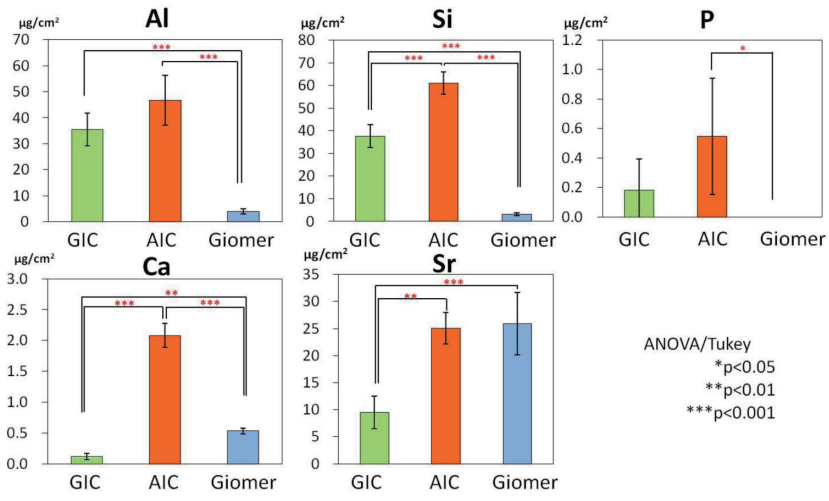

Figure 3. Multi-mineral release test

It is considered that AIC, novel dental material brought the decalcification and remineralization of the tooth substance, and bioactive effects such as the buffer action

結　論（Conclusion）：

HAp nano-particles dispersed into AIC matrices and AIC is superior in multi-mineral-ion release function to GIC and S-PRG filler containing composite resin. HAp may play an important part in improving characteristics of GIC, as well as inhibiting secondary caries and antibacterial properties.

成果発表（Research Achievement）：

邱 秀慧，邱 思瑜，西村貴子，鄭 佳佳，篠永ゆかり，阿部洋子，有田憲司：シーラント用アパタイトアイオノマーセメントの各種イオン溶出に関する研究。第 33 回日本小児歯科学会近畿地方会大会，大阪市，2014 年 10 月 5 日（Poster Presentation）