INTRODUCTION:
Over the past 15 years, considerable effort has been expended in order to retrieve porous coated implants from donors, postmortem, who had previously successful clinical outcomes. These types of implant retrievals are essential if the possibilities and limits of skeletal attachment using porous coated total joint replacements are to be understood.

The objective of this study was to examine and measure the human cancellous bone response to 13 porous coated total knee devices that had been consecutively retrieved from 10 male donors. The following hypotheses were examined: (a) There will be differences in the amount of bone ingrowth measured in the porous coating when comparing the data from the patellar, tibial and femoral components; (b) the amount of bone ingrowth measured in the porous coating cannot be greater than that of the host bone at a given anatomical site.

MATERIALS AND METHODS:
The components in this study were of the Natural Knee design with a commercially pure titanium porous coating with an average pore size of 530 µm and 55% porosity. All surgeries were performed by one surgeon using a layer of autograft bone chips at the interface of the components. The average age of the patients at death was 76±6 years (66 to 87 years). The implants were in situ for 7±3 years (1 to 12 years). The modified HSS knee scores evaluated 3-7 months prior to death averaged 98 for the series. Gross analysis and contact x-rays were taken for each of the components. The components were processed and embedded in methylmethacrylate. Once the specimens were polymerized, they were cut into 3 mm sections (7 patellae, 8 tibial and 16 femoral wafers). High resolution contact radiographs were made of each 3 mm section for determining the appositional bone index (Bloebaum, 1997). Backscattered electron imaging analysis was conducted to determine the percent volume fraction of bone ingrowth (BI%), the percent volume fraction of periprosthetic bone (PB%), and the percent volume fraction of host bone (HB) 3 mm from the interface, in each implant. This analysis was completed using the JEOL 6100 and the Oxford ISIS system (Figure 1). There were a total of 1078 images captured for the patellae series, 2389 for the tibial and 4880 for the femoral series.

RESULTS:
The appositional bone index was 65±15% for the femoral components, 76±17 for the tibial and 90±9% for the patellar components. This suggests that the radiolucent lines (0.5-1 mm in thickness) were minimal but more frequently observed along the interface of the femoral components (p<0.05). The amount of bone ingrowth and host bone 3 mm away from the interface showed that there was a statistically significant (p<0.05) relationship to the amount of host bone present and the amount of bone measured in the porous coating (femoral components 5±2% BI and 5±4% HB; tibial components 6±2% BI and 10±4% HB, patellar components 15±10% BI and 20±1% HB). The data showed that the amount of bone ingrowth measured in the porous coating appears to be dependent on the amount of bone present at a specific anatomical site in the knee. The periprosthetic bone at the interface of the femoral component measured 10±3% PB. The periprosthetic bone at the interface of the tibial component measured 15±5% PB, while the periprosthetic bone at the interface of the patellar component measured the highest with 20±7% PB. This data demonstrated that the highest amount of cancellous bone was measured at the interface region where the autograft bone chips had been surgically placed.

DISCUSSION:
The results of the study showed that there was a relationship to the amount of human cancellous bone ingrowth and the amount of host bone at a specific anatomical site. Also, the amount of bone ingrowth appears to be dependent on the amount of bone available at the anatomical site proving the second hypothesis. The results of this study suggest that consistent bone ingrowth attachment to porous coated devices with minimal fibrous tissue interposition between host bone and porous coating can be achieved clinically. The surgical convention of using autograft bone chips at the time of surgery appears to be helpful in preventing fibrous tissue formation increase the amount of periprosthetic bone (PB%) and provides a neocortex to assist in maintaining the skeletal attachment of the implants.

REFERENCE:

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