

## Observations on the intrinsic blood supply to the human patella: disruption correlated with articular surface degeneration

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### Summary

The intrinsic blood supplies of 13 human patellae with varying degrees of articular surface degeneration were studied by perfusion techniques. Disruption of the normal pattern of arterial arcades correlated with increasing surface wear.

### Introduction

Several workers have studied the extrinsic blood supply to the human patella<sup>1-3</sup> but scant attention has been paid to the intrinsic blood supply, especially in disease states. This subject is important because of the increasing number of operations involving the patella - notably total knee arthroplasty - and the relation of patellar complications to ischaemia<sup>4,5</sup>.

This study and other work<sup>6,7</sup> point to a correlation between articular cartilage degeneration and disruption of the normal intrinsic arterial pattern which would seem significant as it is the degenerate patella that is resurfaced.

### Materials and methods

Thirteen patellae from 12 cadavers aged at death between 50 and 91 years were studied. Patellae were

prepared by warm water flushing of the external iliac artery followed by perfusion with 2 l of warmed 40% barium sulphate suspension at 40 kPa pressure. Patellae were excised, fixed in 10% formalin solution and decalcified in phosphate-buffered 5% nitric acid solution.

Decalcification was monitored by interval radiography until deemed complete. Articular surfaces were inspected with a hand lens and any degeneration graded I to IV. Patellae were sectioned to a final thickness of 2 mm in either the transverse or coronal plane. Specimens were photographed. Micro-focal radiographs were also obtained using fine-grain film and a Hilger-Watts generator (40 kV, 40 mA, 6 min exposure).

### Results

The grade of articular surface degeneration and the degree of disruption of the intrinsic arterial blood supplies of the 13 patellae are shown in Table 1. Transverse sections of non-degenerate patellae revealed preservation of articular cartilage depth and a well defined anastomotic arterial arcade. Blood vessels running towards subchondral bone became increasingly narrow in diameter (Figure 1).

By contrast, sections of degenerate patellae revealed fibrillated, thinned or absent cartilage with disruption of the arterial arcade pattern and formation of subchondral bone sinusoids (Figure 2).

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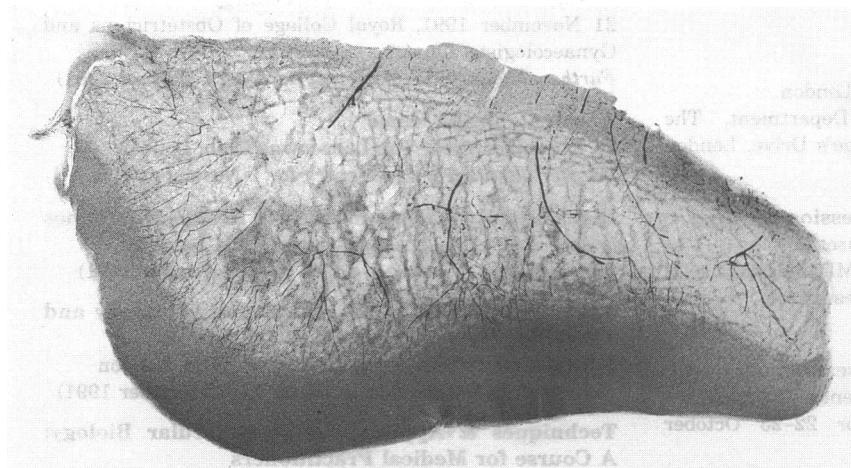


Figure 1. Transverse section through patella 4 showing good depth of articular cartilage and arterial anastomotic arcades

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Figure 2. Transverse section through patella 9 showing thin articular cartilage, disruption of arterial arcades and subchondral sinusoids

Table 1. The grade of articular surface degeneration and the degree of disruption of the intrinsic arterial blood supplies in 13 patellae

Patella	Articular degeneration	Arterial disruption
1	Nil	Nil
2	Nil	Nil
3	I	Nil
4	Nil	Nil
5	II	Mild
6	Nil	Nil
7	I	Mild
8	II	Mild
9	III	Severe
10	IV	Moderate
11	III	Mild
12*	IV	Severe
13*	IV	Severe

\*Patellae from the same cadaver

### Discussion

The recognition of avascular necrosis and stress fracture as complications of patellar surgery has stimulated research into its blood supply<sup>3-8</sup> leading to recommendations about how surgical damage to it can be minimized<sup>9</sup>. These recommendations focus on the extrinsic supply however. Variables such as patellar osteotomy depth, thermal damage from cement and the number and depth of keyholes used to anchor the prosthetic button are seldom discussed<sup>10</sup>, factors which affect the intrinsic supply directly.

This study confirms the observations of others<sup>6,7</sup> that degeneration of patellar articular cartilage consistently correlates with disruption of patellar blood supply; arterial arcades are destroyed, anastomoses broken, sinusoids form in subchondral bone. The intrinsic blood supply to the degenerate patella is compromised before it is operated upon; surgery can only jeopardize it further, increasing the risk of stress fracture and avascular necrosis.

Debate about the wisdom of resurfacing the patella during total knee arthroplasty continues; excluding

it leaves significant patello-femoral pain in as many as 50% of cases<sup>5</sup> but some surgeons do not resurface if the macroscopic appearance of the patellar articular surface is normal, or near normal<sup>4</sup>. To this debate we would add our observation that patellae with worn surfaces are more at risk of ischaemia-related complications because disruption of the intrinsic blood supply can be predicted. The surgeon must weigh this risk against the disappointment of residual patello-femoral pain when making the decision to resurface.

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