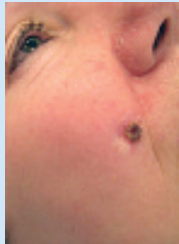


# THE SCALPEL AND THE BEAM OF LIGHT

## Mohs surgery



Kathleen before surgery



Kathleen after surgery



Kathleen today

### CASE STUDY - KATHLEEN MORREY

**It was only a small lump on her cheek but it was fortunate that Kathleen Morrey, 62, got it checked. She was referred to a consultant in Liverpool, where she lives, and was diagnosed with a high-risk basal cell carcinoma, the commonest kind of skin cancer.**

That was bad news but what followed was worse. The former civil servant was warned the surgery necessary to remove the tumour, which was close to her upper lip, was likely to be disfiguring.

“I was so worried about how it would change my face. I remember them telling me they would not be able to do a pretty job. I was devastated,” she said.

It was at that point her husband Jim read about the specialist treatment available at St John's Institute for Dermatology in London. It seemed to offer a glimmer of hope. She was referred for Mohs Micrographic Surgery - a technique in which the skin is removed layer by layer in slices as thin as 1mm. The surgeon examines each layer under the microscope for the presence of cancer cells before removing the next, ensuring that all cancerous tissue is excised whilst the surrounding healthy tissue is left intact.

Kathleen had her operation under local anaesthetic, was given the all clear the same day and the area was repaired without a skin graft.

Conventional surgery would have left her with a bigger wound, as it would have required a 4-6mm margin around the lesion rather than the narrow margin possible with Mohs.

The edges of her tumour were also difficult to see so the conventional approach would have carried a

higher risk of leaving cancerous cells behind.

Kathleen's operation was carried out in 2008. In May 2013, she passed the five year mark without a recurrence. She remains well and the cancer is now unlikely to return.

“If my husband had not seen that article about St John's I would have had no choice but to go through with the other treatment. I am so grateful for the love and support I received throughout my skin cancer ordeal,” she said.

**Raj Mallipeddi**, the Mohs surgeon at St John's who led the procedure, said: “Kathleen's tumour was the ideal type to be removed by Mohs surgery. Seeing her reach the five year marker shows how excellent the outcome has been for her”.



Kathleen with Dr Raj Mallipeddi: conventional surgery would have left her with a bigger scar





Emma Craythorne: the types of patients seen at St John's have changed. Forty years ago skin rashes accounted for nine out of ten. Today half are investigated for suspected skin cancer

## Mohs surgery

### The growing burden of skin cancer

The types of patients treated by dermatologists at St John's have changed dramatically over the decades. Forty years ago, skin rashes accounted for nine out of ten. Today, half of all referrals are for suspected skin cancers. More than 12,500 patients were treated for the disease at St John's last year.

The population is growing older and there have been sharp increases in skin cancers at all ages. In addition, modern techniques mean that patients who would once have been admitted to hospital and treated under general anaesthetic can now be treated as out-patients.

The development of Mohs surgery is an example of this. It owes its name to **Frederic Mohs**, a general surgeon, who pioneered the approach in the US in 1938 while still a medical student at the University of Wisconsin-Madison.

He used a paste containing zinc chloride and bloodroot to stain the area of the lesion, and then divided it into segments, like a pizza. Instead of cutting vertically into the tumour – the conventional approach – he cut horizontally, removing the skin layer by layer and examining it for signs of cancer cells under the microscope.

Patients had to wait 24 or 48 hours for each tissue section to be 'proved' before it could be examined, requiring repeat visits. Today, the tissue is frozen using a cryostat and can be examined within an hour so the treatment can be completed the same day.

Skin cancers often grow to uneven depths so patients end up with more horizontal slices removed from the pizza in some areas than others.



Frederic Mohs



Christopher Zachary

But the advantage is that only cancerous tissue is taken by the Mohs surgeon – who also acts as his or her own pathologist.

Raj Mallipeddi, consultant dermatological surgeon, said: "As you remove the layers of skin, if you find you still have cancerous tissue you can take more very accurately just from that position. Around high risk areas such as the eyes, nose, ears and mouth every millimetre counts in terms of tissue conservation and at these precious sites it is essential to remove all of the cancerous cells."

"That's the beauty of Mohs - how far you go is driven entirely by the cancer. Then you can reconstruct the defect safe in the knowledge that you have removed all of the cancer."

### How Mohs surgery spread

Frederic Mohs spent his life promoting the technique he described, teaching it to doctors from all over the world. Nevertheless it was several decades before a modified procedure was accepted by the mainstream. This was introduced to St John's in the 1980s by **Christopher Zachary** (pictured above), following a fellowship in the US and with

the help of the then Dean, Professor Malcolm Greaves.

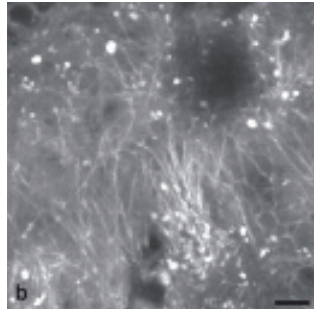
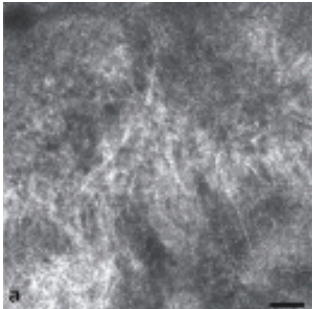
Sean Whittaker, consultant dermatologist, said: "I remember his discussions with Malcolm Greaves [then head of the department] who was a physician and complained that it sounded unusually complicated. Chris was a larger than life character and he gave a wonderful lecture on the subject. From then on, Malcolm was hooked."

Zachary's immediate successors were Neil Walker, who maintained the Mohs service and introduced the laser service and Andrew Markey who was responsible for the design of the current unit. The clinical service and academic profile were further developed over subsequent years by Richard Barlow, Habib Kurwa and most recently Raj Mallipeddi, the incumbent lead clinician. It is now the largest Mohs service in the UK performing over 1000 operations per year. The unit currently has four Mohs surgeons **Raj Mallipeddi, Richard Barlow, Emma Craythorne and Nisith Sheth**. The unit is responsible for training the next generation of Mohs surgeons and has two 1-year fellowship trainees at any time.

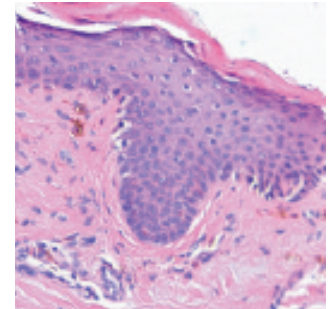
As well as *basal cell carcinomas*, the Mohs technique is also suitable for *squamous cell carcinomas*, *lentigo maligna* and rarer cancers such as *dermatofibrosarcoma protuberans*.

The next stage in the development of Mohs surgery is being pioneered at St Johns to speed up the examination and diagnosis of the removed skin slices. The Institute has acquired several confocal scanning microscopes, the first of their kind in the country.

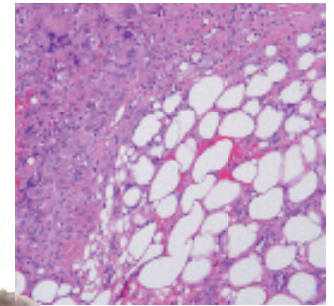
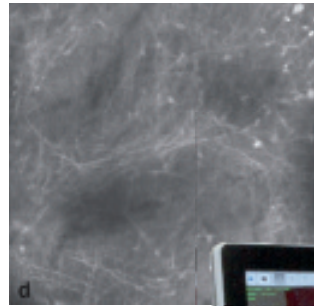
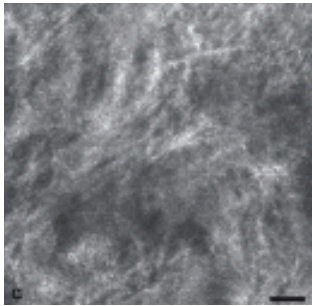
The device can "see" into the skin, acquiring images from different depths. This enables it to



Nisith Sheth



Lentigo maligna



Dermatofibrosarcoma Protuberans

Seeing into the skin at different depths

scan removed tissue for signs of cancer in three minutes so that patients do not have to leave the theatre while the surgeon examines the specimens and the operation can be completed without interruption.

Nisith Sheth, consultant dermatological surgeon, said: "It is very early days and we are still in the research stage. But it is very exciting. We are the only Trust to have this microscope."

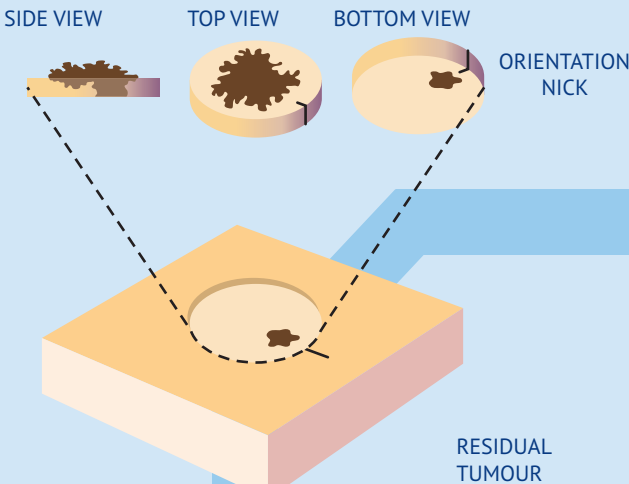


St John's is the only hospital in the country to have confocal scanning microscopes which can see into the skin at different depths, speeding diagnosis

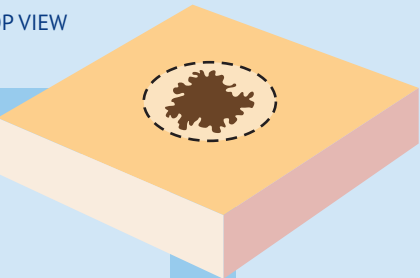


Mohs Surgery: THE PROCESS

**Step 1:** Skin cancers can form roots which extend beyond the visible portion of the tumour. If these microscopic roots are left behind, the skin cancer will recur. What is seen visually from the surface of the skin does not always represent what is present microscopically, like a "tip of the iceberg."



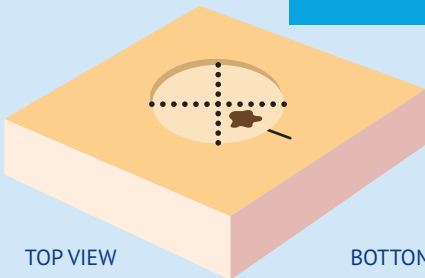
TOP VIEW



SIDE VIEW

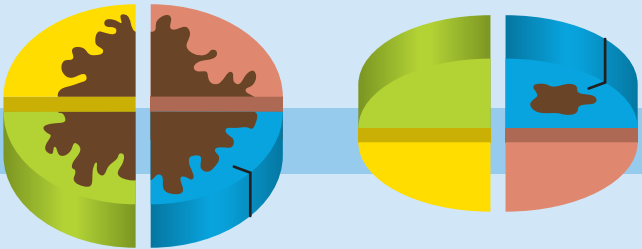


**Step 2:** The visible portion of the cancer is first removed in a thin "pancake-like" layer. A small nick is placed in the specimen and the wound bed for orientation. A map of the surgical site is then drawn.

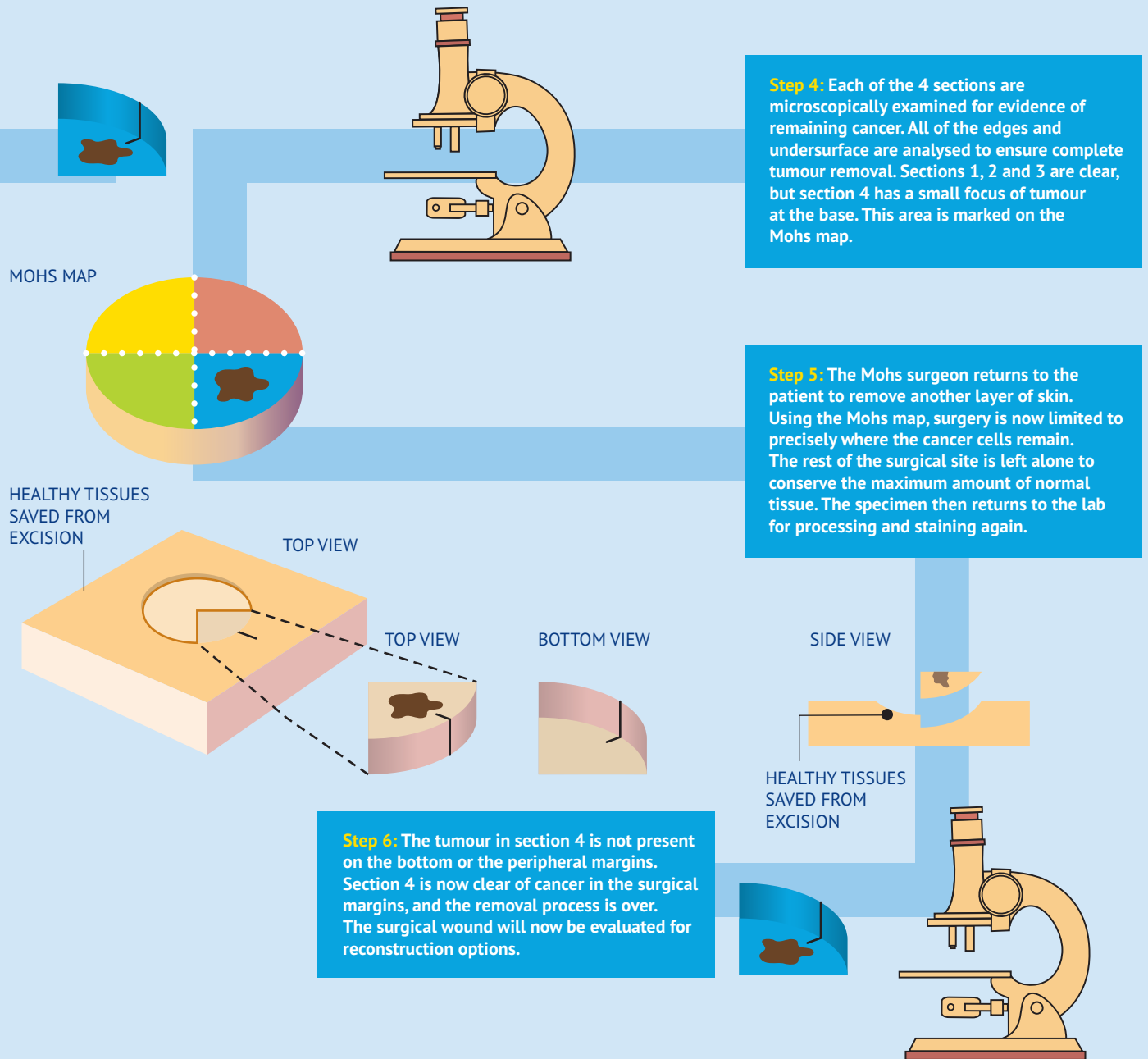


TOP VIEW

BOTTOM VIEW



**Step 3:** The removed layer of skin is taken to the Mohs laboratory where it is colour coded and sectioned for processing. The tissue sections are then stained and made into slides for the surgeon to review.



## Laser Treatment



Ann before treatment: "If only they had invented it when I was a child"

### CASE STUDY - ANN LAYTON

**Ann Layton of Felixstowe, Suffolk, was born with a large birthmark covering the right side of her face and extending up into her scalp. Now aged 69, she still recalls the agony of coping with her disfigurement as a child.**

"It was very difficult. At boarding school there was nowhere to hide. The pupils were quite sympathetic – the headmaster warned them about bullying – but people would sometimes say: 'Who's bashed you in the face?'"

From the age of four she was taught to use make-up. She has spent much of her life since living under cover. "I wouldn't open the door to people till I had got my make up on. When I was first married my husband didn't know for some weeks about the birthmark. I never allowed him to see me without make up. I was very hung up on it."

As a child she remembers being treated with a "radioactive liquid" that was smeared on her face and left in place. "I was not allowed to wash my face for ten days. But it didn't do much."

Then in 1988 a TV programme was broadcast about a new Argon laser being used to treat skin

conditions.

"I was bombarded with calls from friends asking if I had seen it and suggesting I go for treatment. So I did."

For the next decade she went regularly every six months for treatment which turned out to be a punishing regime. The primitive laser could only treat an area the size of a 50 pence piece at a time and it worked by effectively burning the skin.

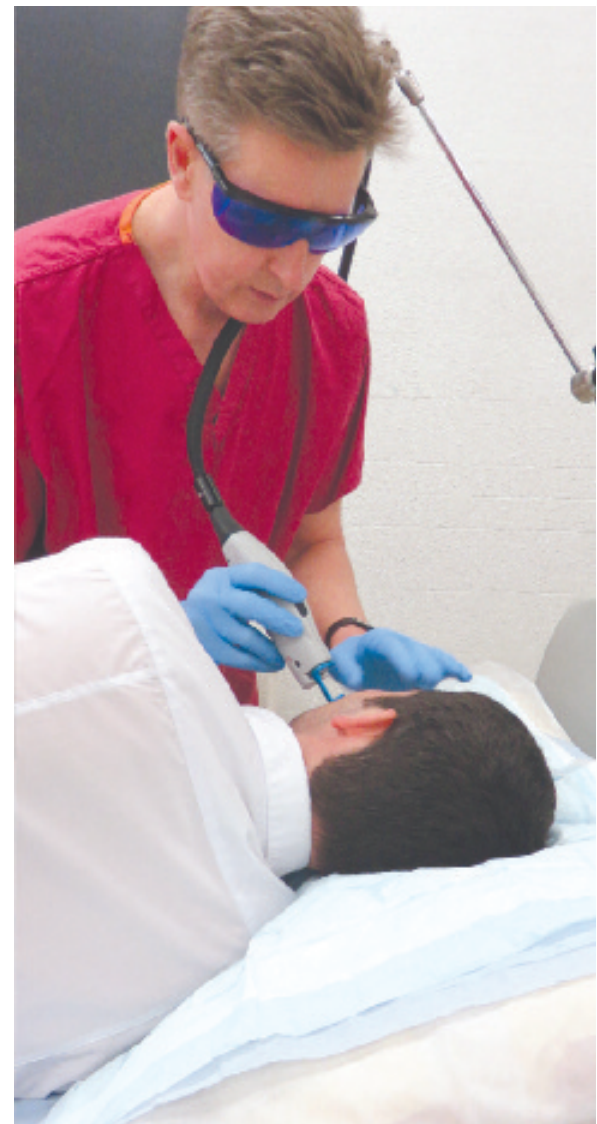
"It was very painful. A blister came up after each treatment so you couldn't put make up on. I had to wait for days afterwards. I kept going for ten years – it made some improvement but not a lot."

In the late 90s she heard St John's had acquired a new Pulsed Dye laser which offered significant advantages over the old Argon laser. She got herself referred again. This time the treatment worked.

"It was completely different. The whole area was targeted in one go and I had six weeks between treatments. There was a bruising effect but no pain. I improved quite a lot".

Two years ago she was seen for review and has had 9 more treatments at St John's provided by consultant Emma Craythorne. "There was no pain. It was like someone pinging an elastic band against your skin. Dr Craythorne said: 'We are going to make the skin perfect' and to be quite honest that is what they have achieved."

"If only they had invented this when I was a little child. It would have saved all the hassle."



Richard Barlow with the Pulsed Dye Laser: used to lighten port wine stains and similar lesions



### *Treatment with a beam of light*

Lasers, which emit a beam of high-intensity light, have come a long way from their beginnings 40 years ago. The first Argon lasers of the type used to treat Ann Layton had a serious side effect. They often caused unsightly scars to form. Today's devices are more sophisticated and selective, emitting beams of specific wavelengths which can be targeted more accurately to treat different conditions.

St John's is one of the largest laser units in London and a referral centre for the whole UK. It has six types of laser – each with a specific target. The wide range of wavelengths available allows very close matching to the absorption characteristics of certain tissues, such as melanin or haemoglobin, and the narrow bandwidth that can be obtained minimises damage to the surrounding tissue.

The Institute offers treatment for birth marks such as port wine stains, *haemangiomas* (a swelling formed by an abnormal collection of blood vessels), pigment disorders causing brown on the skin, *keloids* (bumpy scars) and unwanted hair (of a severer kind than that treated in beauty clinics).

Much of the treatment is carried out by highly skilled clinical nurse specialists who have been trained in laser techniques and who run the laser clinics – an example of how nurses are increasingly taking on roles that were once restricted to doctors.

**The Q-switched lasers** are used to treat pigmentary lesions such as freckles, brown patches on the skin, and *Naevis of Ota*, a condition which manifests as dark patches on the face and around the eyes. It is also used to remove tattoos.

The laser beam's wavelength is set to target brown colour so it is absorbed by cells containing melanin in the skin which are selectively destroyed, leaving the rest of the skin unaffected.

The Q switching technique allows the production of a pulsed beam of light of higher power than would be possible with a continuous beam, which can penetrate the skin to greater depths without damaging healthy tissue. In the case of tattoo removal it shatters the tattoo pigment into tiny particles which can then be cleared by the body's lymphatic system. Full removal can take between six and twenty treatments depending on the amount and colour of the ink, with a month between treatments.

**The Pulsed Dye Laser** is used to lighten port wine stains and similar vascular lesions by targeting the redness of the blood vessels just below the skin. The laser causes the blood vessels in the lesion to heat up which destroys them, leaving a bruise which fades over a few weeks. The laser produces significant lightening of the lesions without affecting the skin's texture or causing scarring and is

safe enough to be given to young infants.

**The V-beam laser** is a new, refined version of the pulsed dye laser which has a greater variety of settings to deliver more energy in a more targeted fashion. It is the gold standard pulsed dye laser treatment for a wide variety of vascular lesions.

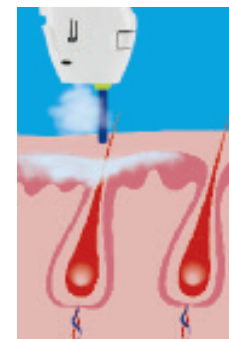
Richard Barlow said: "There was a much higher risk of scarring with laser treatment in the past. Now lasers are more precise with targeted treatment so that normal tissue around the lesion is less affected. The energy is delivered more where it is needed, dramatically improving safety."

**Intense pulsed light**, often abbreviated to IPL, is used for hair removal and to treat vascular lesions. It is not a true laser because the pulses are distributed over a range of wavelengths. The broad spectrum light penetrates the skin and is absorbed by the melanin concentrated in the hair roots which heat up and are destroyed.

**The Alexandrite laser** is a more sophisticated hair removal device which is better targeted on the brown colour of the melanin at the base of the hair follicle. The stronger the treatment the greater the



The Q-switched laser: to treat freckles and remove tattoos



The Pulsed Dye Laser: targets the blood vessels

likelihood of side effects such as redness, swelling and tenderness but these subside after a few days. Added cooling systems with each laser make treatment quicker than in the past and reduce side effects, so patients can return to work and normal activities sooner.

**The CO2 laser** targets water in the tissues and has an ablative (burning) effect. It is used to treat big keloid scars which would otherwise have to be cut out with a scalpel. The laser does the same job in a bloodless way, as the beam cauterises as it cuts. It is also used for skin resurfacing – essentially burning the skin to promote collagen formation – as a treatment for wrinkles, sun damage and warts.



The CO2 laser (above and right) : treats wrinkles, sun damage and warts as well as big keloid scars. It targets the water in the tissues and has a burning effect.



## Skin imaging

**Before a patient with skin cancer can be treated the diagnosis must be confirmed. This is normally carried out by taking a biopsy – surgically removing a sample of skin which is then examined under the microscope for signs of cancer. The process is painful, potentially scarring and causes delays.**

Now St John's has an alternative

The **in-vivo reflectance confocal microscope** is described as opening a "window into the skin".

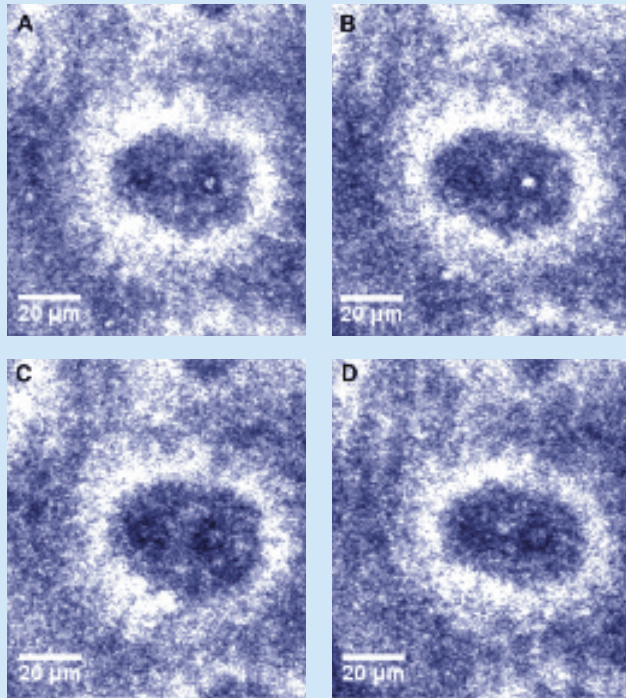
The device allows the surgeon to examine a mole or other skin lesion directly, by placing the microscope onto it, which can then "see" through the epidermis down into the layers below.

The microscope scans down through the lesion and can reveal individual cells down to the upper reticular dermis. This enables the surgeon to painlessly examine the living tissue layers avoiding the need for biopsies.

Emma Craythorne said: "Devices such as this can improve our pick up rate of malignant lesions . We need to minimise the false alarms while ensuring no cancers are missed. The use of these skin imaging techniques is going to make that more likely."

Patients with *lentigo maligna*, a precursor of melanoma are among the early beneficiaries of the technology. *Lentigo maligna* forms a flat lesion usually on the head and neck that may be particularly large.

The Vivascope allows the entire large lesion of *lentigo maligna* to be visualised and the borders accurately delineated . The technology does what all innovative technology should – it enables surgeons to do more with less.



The in-vivo reflectance confocal microscope opens a “window into the skin.” The surgeon can examine a mole directly and see through the epidermis into the layers below, removing the need for painful and invasive biopsies.

