audio1986892168

[00:00:00]

**Emma Blamont:** Okay. All right. Thank you everyone for joining us and welcome to today's conversation with Dr. Hannah Levi, Dr. Vito Romano and Peter Fenwick. In today's webinar, we'll be talking about Hannah's work in creating artificial corneal graph. We'll also be hearing from Vito about how this research might translate to clinical practice, and Peter will be speaking about his recent experience of having a corneal transplant.

Before I get started, we have just a few housekeeping pointers to put you at ease. There will be live captions available during the webinar as usual. And as usual slides, a transcript and a recording will be made available to all registrants post-webinar. So even those who couldn't make it today will still get access to the materials.

So you can tell friends that please use the q and a window to ask questions. The chat function has been disabled. So don't hit chat. And after the webinar we'll send you an email, [00:01:00] which will include a short survey and it'd be really helpful if you could complete this just to give us some information about how we can better develop the webinars in the next run of series to ensure they meet everybody's needs.

Okay. So I'm Dr. En Lamont and I'm the head of Research and Programs at Fight The Site. I'll be a host today and as mentioned with us today, we have Dr. Hannah Levies, a reader in Ophthalmic bioengineering at the University of Liverpool, who'll be talking about her. Hannah's a past recipient of a fight beside Grant which enabled the development of the concept of what she's gonna be talking about today.

And we also have Vita Romano with her Dr. Vita Romano, professor of ophthalmology at the University of Resha. Vito has held a Fight for Sight grant previously in the past. But Vito is really gonna be talking about how research like Hannah's might translate to improvement [00:02:00] in clinical practice.

And last but not least, with Peter Fenwick with whose lived experience of having a corneal transplant. And he's gonna be sharing his story with us all and excited to hear research might.

So to start the webinar, I'm gonna tell you a bit about us. We Fight for Sight and we found the brilliant minds of bright ideas that put the change into site. Really the next slide. This site has our brand story. And imagine that you were told or somebody you love were told that they were losing their sight at that moment.

You probably have two questions. How can it be stopped or how can I or my loved one live their lives? So really to address these pertinent questions. As a charity, we plan to distribute 30 million in grants across our research and our social change funding programs in the hope of saving sight and changing lives.[00:03:00]

So today we're gonna be focusing on the scientific research funding. Our researchers are working to better understand, diagnose, prevent, and treat vision loss. And as mentioned today, we really pleased have one of our researchers, Dr. Hannah Levi, here to talk about some of the work we've been funded Dr.

Vita Romero about the clinical applications of this work, and Peter to tell us about his story. So we're gonna start off with Peter who I try and get a little bit of the patient perspective of having a corneal transplant. Peter, you've recently had a corneal transplant. Could you tell us a little bit about your condition, what led you to have the transplant and your experience with getting the procedure?

Yes I can. And hello to everybody. I started some years ago when of my right eye was losing sight. I'm 75-year-old now I [00:04:00] thought the cataracts or something on those lines would be the problem. But after being examined, it was a a cornea problem. And I knew eventually I would be in trouble if I didn't get something done.

And I was lucky to be put on the list because I realized at being 75-year-old that I wouldn't be at the top of the list for obvious reasons. And but I was lucky because I'm retired and I could get there in 24 hours because I believe the transplant don't last very long. So I was lucky that I was 20 mile away, but I knew I could get there and everything was sorted.

So that was to my advantage. The other good thing was that, professor K who I saw at Liverpool Univer at Liverpool Hospital, St. Paul's. I could have everybody's putting their name down for him to do the operation, and it's a teaching hospital. So I said I would [00:05:00] have anybody that was suitable with obviously the skill to do it.

That gave me another bit of an advantage because I didn't, it wouldn't, I wasn't worried that somebody who was being taught about the thing that so anyhow, I took it. Long story short if you read exactly all the bump that's about 20 pages of having the operation it would put most people off, I think, because having your eye operated on, it's probably one of the worst things that anybody could ever want.

And then when you get to, and it has to be stitched and it goes on and on. Anyhow another thing when I did go in for the operation, I. I have had chest problems in the past and they was a bit reluctant to give me an anesthetic, so I just had to have a local so I could see everything that was going on.

But it had to be. So what they did was they covered up my left eye which was the good eye and then operated on the right eye. [00:06:00] I could see with it a lot of things going on and I could hear as well at the same time. So I am a pretty knowledgeable about the operation. Dr. Professor K was there at the time as well, and fortunately there was a nurse holding my hand all the way through.

As they, I could see the surgeon coming in with the knife or what have you, and then most of it got blurred because of it, but I must admit there wasn't much pain. So it's more a mind over matter and when they got down to the stitches I could I could feel that obviously, but not to the point of.

And after the operation there is very little after pain. I was surprised 'cause at my age you've had quite a few operations on things and replacements and you always have pain for recovery and this kind of thing. The recovery on this was very good. The, I would say the worst part about it [00:07:00] is you have to literally rely on your back after the operation for about 10 hours.

There's a gas in your eye to hold it in place and a little bubble that flows about. And this, just make sure that nothing silly happens. You've allowed a 10 minute break every hour to go to the toilet or whatever. And then when you go home, you have to do it the same thing again for the next two or three days, which is literally lying down, which I'm pretty good at normally.

But for take for long time periods. So you've got to really take it seriously. And at the end of it all, it's been absolutely brilliant. I've I've now got minus one eyesight in that eye. The glasses I've got on at the moment, it is pure glass in that eye. The other one, I'm waiting for some more glasses coming to allow for the other one and everything sorting.

But I actually it's made a vast difference to, [00:08:00] to me in, in, in well need explaining in every walk of life. I've tried. I actually, I'm better off without glasses now. And if I can have a slight cataract problem with the other eye, and I think that if that's sorted, I probably don't need glasses at all, so I can understand it.

I, like I said, I was lucky because of the actual waiting time, I must have. I, you have, a pre or medical, which lasts for three months. And in that time you may be called upon in those three months to, to wait. I got on to be second three months because obviously because of shortages and whatever the list and and this kind of thing.

And then when it did come, I just went for it and it came out, it couldn't have gone better. A couple of things I didn't understand is when you have cost to the opticians, which I did every two years, I think it is regularly, 'cause I drive, they, they cannot pick it up or spot [00:09:00] it. They haven't got that.

Peter.

**Emma Blamont:** Yes, Peter, sorry to interrupt you. I was just wondering, could you tell everybody what led to you having the corneal transplant? Was there, was there a particular eye condition that you were told you had by your doctors?

Yeah. The it started a few years ago when it gradually started going well, going worse.

And then it got to the point where it was very hazy. And there was. It just, I just could not go on like that. I couldn't drive. Yeah. And all the things with it. And so I saw luckily I did see this, another professor in Orangeburg who diagnosed it and then on, it went on and on from that.

So really I've been fortunate. Is there anything else you wanted to ask about that?

**Dr Hannah Levis:** I think from what you were saying to me earlier, Peter, I think it might have been corneal endothelial dystrophy which is one of the diseases that's an indication for corneal. And it's ready for Yeah, it [00:10:00] can be.

Yes. It can be passed out with the family. Yeah, exactly.

Yeah. So really I'm just a good example if you can do it for somebody, a 75-year-old and and, actually recover. And I would imagine that if there was more available I think things can only go on really. I, and there are people a lot worse than me and I just hope everything succeeds with getting a, an alternative.

**Emma Blamont:** So it sounds like you were quite lucky too, Peter, with waiting times because people can typically wait up to 18 months for a corneal transplant. Is that correct, Hannah? No, that's correct.

Yes. That's why I was saying I was quite lucky because, and I think it was pure luck as well as being a teaching hospital.

And I did, when it got past the first three months it, it is, you cannot do anything because you've on call for 24 hours. And you've got to be prepared to go and get everything sorted [00:11:00] out. So I got on to me second three months and I thought I was still doing well. Really, until I got the call which was very good. I don't know whether there was a delay with getting in touch with my doctor about the physical health and mental health or whatever. But but other than that I can't say how good it is. The first one was what was going to come from Italy, I believe if I'd have got cut the call.

But mine, I actually came from America to transplant. And I, so I I can't really say much more. I

**Emma Blamont:** so this is probably a good point to find out why Dr Levis's research could revolutionize and change all that. Peter, would you have any questions to ask Hannah?

I haven't really the only one that I, that puzzled me was if all these, this one came from America, whether how good of that one was that they were replacing with Neil.

So there must be some tests, and now you're going to reproduce it. That's brilliant. Other. [00:12:00]

**Dr Hannah Levis:** Yeah. So yeah, that's really interesting that you say that your corneas from America, because that is one of the issues that we have in the UK and globally, is there is a shortage of donor corneas and some countries do have an excess, like America and Italy, but many countries don't have enough corneas to go round.

So there's 12 million people globally waiting for a corneal transplant. And yes, as you said before, Emma, the typical waiting time can be up to 18 months. So in that time the eyesight can deteriorate and even more things that the people can't and are not able to do. That really impacts patients and their, their daily lives.

So one thing that we're looking at is to try and reduce that burden on the patient waiting is to create this artificial corneal graft. So instead of when you have a donor that's donated from somebody that's died, you obviously that one cornea can go to typically one patient. What we do is we take the donor cornea pair and we take it to the lab and we take off the corneal endothelial [00:13:00] cells.

So those are the cells at the back of the cornea that have gone wrong in the case of Peter and need to be replaced. And we grow them up in the lab and multiply 'em greatly a number. And then we are adopting this this process where we take a biosynthetic or a hydrogel. So a hydrogel is typically, if you've seen daily disposable content lenses, they look like a little gel.

That's a hydrogel. So we've developed this particular hydrogel that works really well and we take these corneal cells and we put them on the surface of this hydrogel, and we can create a corneal graft in the lab, but instead of having just one cornea for one patient, we can create 20, 40, 60 grafts from that one donor pair.

So it means that we can potentially treat 60 patients just from one cornea, and we think that this would decrease the patient waiting time, meaning that they can get treated a lot earlier and can reduce the burden on those 12 million people waiting transplant.

**Emma Blamont:** That sounds [00:14:00] amazing. And thinking about how you can, exploit something like a sort of almost like a contact lens technology to provide a scaffold to grow an artificial cornea.

So I guess one of the questions we wanted to ask Hannah is what made you interested in this sort of corneal graft research and actually within the corneal research area? Full stop.

**Dr Hannah Levis:** Yeah, so it is a roundabout way that I got to it because my undergraduate degree was in neuroscience.

So I was looking at the brain and in particular stem cells of the brain and seeing if we could use these stem cells to repair the brain after brain tumors. So that's how I got into growing cells in the lab and repair as translational therapies. But I, then I went onto looking at retinal stem cells, so that's the back of the eye.

And obviously connected to the brain. So that's how I moved from brain to retina. And then I was working next to a lab that was looking at cornea. And it, I found it really interesting because obviously it's the clear window at the front of the eye. It's really [00:15:00] easily accessible. We can do imaging, we can see right.

In a patient what's going on in the eye. So it makes it really an accessible tissue to work on. And then I got a postdoc position after my PhD with Professor Julie Daniels at UCL Institute of Ophthalmology. So it's connected to Morefield Eye Hospital, which many people will know. And she did lots of great work on repairing the front surface of the cornea, using also a biomaterial and some cells.

And working with her, she was such a great mentor. She was really inspirational. And in particular working with translational therapy. So patient research that was very close to getting into the patient. So I started a project repair, but 13 years later went into a patient. And that is inspirational for me to work in that kind of field where we can see patient benefit in, in our research time.

Yeah. Really inspired me to work in the cornea. And I've moved about half a millimeter back, so from the front of the cornea to the back of the cornea now working on corneal endothelial cells. That's what [00:16:00] set.

**Emma Blamont:** It sounds fascinating to see the benefits and you've really moved from the inside towards the outside is the impact, thinking about neuroscience, then moving through the eye to the cornea,

**Dr Hannah Levis:** it's much more difficult to fix the brain. So I'm going the front of the eye relatively.

**Emma Blamont:** Vito what sort of conditions then do you think, not think, what typically what conditions might require somebody to have a corneal transplant

and how So the corn,

**Emma Blamont:** sorry.

People might actually be perhaps interested to know how technically different, difficult the surgery is. Yes, and how long it might take.

So the the cornea transplant, we need to understand what is the cornea. The cornea is able, is focused the light on the back of the eye. So it's able to tell you which is the pathway of the light.

So any condition that ated the morphology of the cornea. So the [00:17:00] shape or the clarity. So the transparency, it's a condition that can get can give you it syndicated for cornea transplantation. So the most common one, alter or comms or foin dystrophy as a peter or had it so the the folks corneal dystrophy would happen that the inlay of the cornea doesn't work anymore.

It's not able anymore to remove water from the cornea. Keep transparent and for this reason become cloudy. And you need to replace the inner layer of the cornea with the new layer that is able to do the work and make the cornea clear and the patient come back to see. Instead the keratoconus is change normally the shape increasing the the curvature of the cornea and getting cornea thinner.

And this make a changing of shape that is able is the patient is not able anymore to see very well in the first phase, is probably can see with [00:18:00] the glasses then it benefit of content led in advance cases he need a corn transplant. Then we have all the other disease, some other condition. The most common is microbial keratitis that can end up with a scar.

Scar means that the corn, the tissue of the cornea, it's disrupted and it's not clear anymore. This can be cause of aberration and the patient is not sick. In that case, then you need the cornal transplantation. The cornal transplantation vary, can be full thickness cornea or can be la malar, and that can be anterior la or posterior la malar keratopathy.

Then we have the new avenue that was s research that regarding the additional sur surgery with cornea that is not come from human, but synthetic cornea. The, and surgery more or less last between an hour 90 minutes, let's say. But usually the inner layer of the transplant [00:19:00] transplanting the inner layer of the cornea.

It's taking less time because you need less suture and give you also a faster recovery time. Give you a re, both anterior and posterior ome keratopathy. This is the big advantage as a smaller risk of rejection and compared to peak penetrating keratopathy. So the full thickness graft, and this is the main advantage, the cornea between all the different kind of transplantation is the is the one with less risk of rejection because it's a vascular.

And the holiday things that you need to keep, in particular in penetrating keratopathy or deep anterial keratopathy, you need to keep the suture for a while because being without vascularization take a while de secretization of the wound, the instead of the posterior keratopathy. So the gra the surgery that Peter had was, it's quite, you need probably one, just [00:20:00] one suture that you can re remove after four, six weeks or a few months.

But the recovery vision is quite quick and you don't need too much of topical steroid. Most this kind of surgery does not need systemic steroid, so does not is not a problem for the patient, for the health of the patient. And probably with the harness ground with the harness graft will be even less need of steroid drops as well because you don't have the risk of rejection.

You have very few the risk rejection is very low.

**Emma Blamont:** So what causes the rejection, the risk of rejection then? So

because it's a, it's an organ that come from another person, it's not recognized as itself. And so the body does not recognize itself. And of course, a rejection, this rejection could be could be a problem because of course rejection means that there is inflammation in the tissue.

It's come the white cells, we are going [00:21:00] to destroy that tissue. And we don't want that because of course then we need to do another transplant. And if you already had got a rejection, then you have a high risk to have a second rejection because it's like being already stimulated. And it's an alert, the system.

So if you, the big advantage that thanks to this research and the surgical innovation that we are going, we are moving toward from the full thickness graft to anterior or posterior lanar graft, where you're going to transplant less tissue towards a graft that does not have risk of rejection or was lamellar as and I told you, but without the even less risk of rejection.

So then the big advantage that the research is giving to us, giving like a window, how to do it and where where to go.

**Emma Blamont:** Okay. That sounds amazing. So just like somebody who's having a kidney transplant has a risk of rejection. Somebody who is having a corneal transplant [00:22:00] also could possibly Yes.

Or in the past had an in, had a risk of that, but now that's been coming minimized with surgical knowhow and techniques and research.

Exactly. Our limitation at the moment is we were discussing before is the shortage of a tissue. Exactly. So the shortage of tissue is a key point.

So there are few countries that the there are really shortage. There is not enough donation. But this reason we need some we need more donors or we need alternatives.

**Emma Blamont:** So the limitation for people getting treated isn't the time of the procedure, the complexity. It's just having the materials.

**Dr Hannah Levis:** Yes.

Yes.

**Emma Blamont:** Okay.

**Dr Hannah Levis:** Which is why I do encourage people to think about organ donation as well. Obviously we're developing different ways to do that, but it's always good to think and talk about organ donation with your family members before you die so that they are clear on your wishes. 'cause ultimately, even though we're an optout system, it's a [00:23:00] soft optout system.

And the next of kin always has the ultimate saying. So if your next tokin knows that you'd like to donate, then it makes a decision easy for them. They just say yes. They don't have to think about it in that, that time, but maybe it's a difficult time and a grieving process. Is hard, but if you know the wishes of your family member, it's easy.

So I encourage everybody to talk about it. Organ donation, sign up, donor register.

**Emma Blamont:** That's a good point. So Hannah could go back into your your project brand award with Fight for Sight that sort of, put some of the steps in lay down some of the foundations for this work. Could you tell us a little bit more about it and what you went on to achieve after the project as well, please?

**Dr Hannah Levis:** Yep. So in 2017, I was awarded a project grant, so that, that was actually my first major grant as a pi, as a principal investigator. So it as well as kickstarting my research, it kickstarted my, career as a group leader. And so that was a two year project. So I'm [00:24:00] employed, I employed one postdoc on that project and we had some very preliminary data that we could grow these cells on a on a peptide hydrogel calling it.

And, but we needed to show that it actually worked. And so we did some more work on optimizing the exact hydrogel that we wanted to use and then, and also how to grow the cells in the lab. We developed the method in collaboration with a group in Singapore. They taught us how to grow the cells and so we did some preclinical studies and some in vitro studies.

So that means studies in the lab where we had a model of. The disease. So a non-functioning endothelial layer. So this layer that's damaged in Peter's disease, for example, we damaged that in our model in the lab, and then we put the graft in and we saw that it reduced the thickness of the cornea and increased the clarity.

So it began working as a healthy cornea again. So we showed signs that it repaired the cornea. And then we did some other preclinical studies and showed the same thing. And then we [00:25:00] also we got veto in the lab. He was the surgeon working on these studies, and we got him to input it into in vitro models.

As he would do in surgery. So seeing whether the hydrogel and the graft was flexible enough, it was, it could be folded into instruments that he would use clinically to see if it was actually practically possible to deliver this to the a patient. And indeed it was. So that really gave us a good p good amount of data to get to then go on and apply for a longer, larger grant.

And so I applied to the MRC Developmental Pathway Funding Scheme, which funds a lot of translational research, so trying to move it down the pipeline towards the patient. And I was awarded a 1.4 million pound grant to continue this research. So here we were continuing to optimize the hydrogel. But also growing the cells in a very clean environment, what we call a clean room at the standard of good manufacturing practice.

So that's where we would have to grow the cells if we were gonna deliver them to the patient. So we were [00:26:00] developing that protocol and that was in collaboration with NHS Blood and Transplant in Barnsley. So we're working with them to develop the protocol. Alongside that, we did more safety testing.

So in our preclinical studies we did, I did the surgery and did the safety testing to see if the hydrogel was safe in a, in actually in a, an actual eye situation. And we found out that it was, and so we continuing and this project is still going. It finishes in a few months now, in six months.

Yeah, so without that Fight for Sight grant and that preliminary data, I wouldn't have been able to get that MRC grant to continue the research down there towards the patient. And so we're three years further along and we feel like we've made a lot of progress in that time. Brilliant.

**Emma Blamont:** It's really rewarding to hear about how our funding de-risks ideas and makes them more attractive to secure bigger funding.

So what do you think is gonna happen after, what are the next steps after the MRC grant?

**Dr Hannah Levis:** Yeah, so we do need more funding [00:27:00] because, so now we have it we have at the end of it, we have a product that functions and that we have shown that can work in preclinical models. But in order to get it to the patient, we need to do a lot more work in terms of further safety testing.

So that's usually contract research organizations do that. So they do more preclinical testing. We need to think about how we're going to distribute these kind of tissues. So will we work with I banks, we know if we make six 60 graft at a time, how do we get 'em to the patients at the right time, thinking about how we work with I banks and things like that.

And also commercialization. Who will manufacture the hydrogels? How will we package those things? And then at the end of that, when you have all of that data together, including the safety data, ultimately you need to test it in a patient. So first in human clinical trials, and then larger, longer clinical trials will be needed before this to go to the patient.

And obviously when you have that package of data, then you need to go to the regulators. And so it needs to be signed off as [00:28:00] safe and effective before it can be rolled out to many patients. And obviously for a basic scientist like myself, that seems quite daunting and it's quite, quite a relatively long journey.

But we've had help from things. People like the gene catapult, the regulators get definitions of what. Like a product when we go through to the regulators and just finding partners that we could potentially partner with, commercialize to get it to the patient. So organizations like that are really helpful to us, but it does take time.

So my example earlier was 13 years to get from the start of a basic research project to a patient. Hopefully we can minimize that a little bit by, working with people who've already done it so that we can decrease that time. It does take time. And funding, yeah. Organizations like

**Emma Blamont:** It sounds like a really great project.

Hopefully people like Peter in even though Peter was quite [00:29:00] lucky by the sound of it in terms of his weight, hopefully, people will be able to access treatment faster in, in the not too distant future thanks to research like you as so I think we probably would be a good time now to open up the floor for any questions that we might have.

People could, people who are interested in asking either Dr. Levi or Dr. Ramano, any questions or Peter pop them in the q and a.

So we've got the first questions come in and it says, is this process only suitable for endothelial grafts or would it help in full thickness graft,

**Dr Hannah Levis:** please? Yeah it's a really interesting question. So I think so I should explain that the cornea has five different layers. So you have the epithelial layer is the outermost layer, and then it has a Bowman's membrane underneath it.

It's like a basement membrane. Then the majority of the thickness of the cornea is the s stroma. So that's [00:30:00] what the highly aligned collagen within the s stroma is what maintains the transparency. And then you have a thin dease membrane, which the endothelial layer sits upon. So our graft is replacing the dease membrane and the endothelial layer at the back of the cornea.

So that's what's removed in cases like Peters, when you had fixed endothelial dystrophy and we're replacing that very thin bit of tissue, which is only 15 microns. So half the thickness of the hair for a full thickness transplant that involves the stroma as well. And actually the stroma is quite difficult to recreate because it has a lot of toughness, a lot of strength because it's, it's the physical protection of the back of your eye and the internal of your eye for many insults.

And also because of this highly aligned collagen, the transparency is very high. So creating a material that can replicate that biology has done a very good job of that. And a lot of researchers have tried and are trying [00:31:00] to create a full thickness graft in the lab, but getting that particular strength and transparency is quite difficult.

And we might see some research on 3D printing of cornea. Which involves cells and structures that look like meshwork the College of Meshwork. They're trying to do this, but actually it's quite difficult to do. So we're focusing just on the endothelial layer at the moment because it's typically what's removed in fixed dystrophy, for example.

And so we're replacing just that one at the moment.

**Emma Blamont:** So would it also work this approach that you're developing, would it also work for other corneal conditions like keratoconus, or is it just, would it only exclusively work for foods disappear?

**Dr Hannah Levis:** So keratoconus is, I dunno if vi you're about to say something.

Oh,

**Dr Hannah Levis:** keratoconus is more involved with the stroma is the issue because it's the thinning of the stroma. That's the problem. And so typically we, [00:32:00] because we're not recreating that stromal portion, we're we couldn't for this, but Peter. Yeah.

In the keratoconus, we want to save the inner layer of the cornea.

So we don't want transplant that, we want to transplant everything that is in front of the inner layer of the cornea. So we are not using that one for the reason. And the front part, normally we use tissue that is come from a donor. Alternatives could be something synthetics, but it is not replacing all the donor, but can be an a additive tissue.

So the additive tissue that you're going to put inside of the str of the patient. So you're not removing the kerly, just you are adding some tissue because we know that disease is is due to the change of the shape that increase the curvature and the thinning. So to avoid the thinning exactly, we are going to add some tissue that can be human or synthetic.

However, there is not too much evidence about this [00:33:00] Adi additive tissue because at the moment the vision is not improved as well as removing the tissue and replace it with a donor for this disease. But the research is going, is moving towards that way as well. But at the moment we we need to still see what's happened and if we can improve the vision following the TIC treatment.

**Dr Hannah Levis:** Okay within our department we have another research project, which is headed by Professor Rachel Williams and also vi's involved where they're looking at a novel crosslinker. Because another way to treat keratoconus is to just cross link the tissue, so strengthen the tissue that's already there.

And and the current process of cross-linking needs you to remove the epithelial layer, which is quite, makes it quite painful and not a pleasant experience for patients. But Rachel's been developing a new cross-linking material that can do this without removing of the epithelium, and it's just a drop that's applied in the [00:34:00] clinic.

And other people in the department are developing different things for keratoconus. So it's good idea to keep an eye out on our website at university for other research on ker.

**Emma Blamont:** Thank you for that explanation. Yeah, I think an eye drop is a much preferable way of getting something done in that case.

Any more questions in the q and a?

Let's see.

**Emma Blamont:** Okay. So there's a question for clarification about the corneal graft research and are the question is which might be a difficult one to answer. Are you able to say how long from now it might be before it could reach patients?

**Dr Hannah Levis:** Yeah, it's quite a tricky question because it depends on how at [00:35:00] every stage the research continues.

So I have, as I said, this grant that I currently have is finishing in the next six months. So if we have the data that we can apply for a new grant to do the things that I said before developing a manufacturing route and working with the regulators, looking at commercialization, that could be typically another three year or four year grant, which may end in a a first in human clinical trial with a couple of patients.

Then you would need maybe another three years, two or three years to do the contract research. And sorry, further clinical trials so with patients and larger groups of patients, and typically the patients that would end up with the, this therapy, so you're talking about maybe another three years.

So it could be something like six, six to eight years maybe from now. Okay. That you'd hope to have some patient benefit, rolled out to.

**Emma Blamont:** I suppose that is actually [00:36:00] thinking about everything being lined up, what you know Exactly. Yeah. In an organized manner, continual funding pipeline as well.

**Dr Hannah Levis:** Yeah. Which doesn't always happen. Yeah. The funding is a difficult thing because sometimes you don't know, you don't have all your data to the end of a grant, and then you maybe have to apply then, and then you have a break in funding.

And and obviously things like covid happens, in the middle of sort of research cycles. That's what happened to the product, that I was working on at UCL. They had setbacks along the way. That meant that was 13 years from first principles to patient benefit. But, these days the at mps, which is the space that we're working in advanced therapeutic medicinal products is advancing a lot quicker.

Regulators are, because there's more out there, they're beating things up in terms of getting the patients seen.

**Emma Blamont:** And I suppose innovations in terms of the cancer treatments are helping lay down the groundwork too for some of [00:37:00] these sort of fast advancements and turnovers as well.

Increase speed.

We have the question from for Peter. And the question is, how has your life changed since having your corneal transplant? And I suppose thinking about it what sort of things can you now do that you probably took for granted and realize how much you missed? Yeah, it's a good question.

My first thoughts was if I had or was employed, I would not have been able to carry on employment with, without that operation.

It would, I don't know what I would've done where I the other one is I it's made a vast difference to myself because I am an active person and it the things that it interferes with you can imagine I tested it out at first that I played my son at snooker without glasses and and I did [00:38:00] manage to win one, but that's that I could never, ever even think of playing before.

And there must be other people with bigger problems than that if they are employed. But it has made a tremendous difference with you just take it for granted, the things that you can't do. And really I cannot praise it enough. I just I the, just going back to the waiting list, it was about 12 months really from start to diagnosis to finishing.

It wasn't and made it sound like it was a lot quicker than that. It I think the donor is so there is a long process with it and and this kind of thing. I don't know what percentage of people have cornea problems in generally or what age? I know, I believe it's hereditary.

It can start at any age. Is that true? To regarding the age re regarding the age? It depends from the condition. Probably the age the functional dystrophy can [00:39:00] start usually in a female between 40 and fifties. And probably is more common after six that instead the keratoconus normally affect young people during, I don't know, 15, 16, 18 years old.

And that this can affect really their their life because it's a, it's the age that probably is going, finishing your school, start university or going to work. So I think there it's in a condition that there can really affect the light of the patient. Yeah definitely.

**Dr Hannah Levis:** Can I ask you a question, Peter, because obviously you had a corneal transplant where you had tissue from a donor eye, but how do you feel about having a biosynthetic or, an artificial corneal transplant?

So say we grew the cells in the lab and put them on this hydrogel. How do you feel about that? Would you be as keen to have that as you did your corneal transplant? Do you have doubts or worries about anything?

If I was if I was going to wait any longer I [00:40:00] wouldn't even hesitate. I would definitely have it.

I I'm sure I might have missed this, but when you get a donor, you've only a limited amount of time before you transplant it. Now the synthetic one, is that a longer life span, do you think? How long do you think

**Dr Hannah Levis:** With cornea transport, when people donate? In Europe they, when they remove the cornea from the eye, they put them in a media, which is like a liquid, which helps the cells survive.

And in Europe you can keep them in that liquid for up to 30 days. So actually quite a bit of time so that they can, they, transport their eyes, find the correct donors, like people like yourself who are waiting on the waiting list. In America, they have a different liquid that they put the corneas in and they can keep them in there for 14 days after the person, after they've removed it from the person that's died.

So there is a bit of time so that, that helps. So with our graft, it will be similar probably. So we'll get the corneas from the [00:41:00] people who've died, grow the cells, and then they'll be put in this similar sort of transport medium and then shipped to the relevant people. And we'll probably have maybe a week or so where the cells are ready and then they can go to the patient.

They do, the cells do take time to grow in the lab, so it will be, I can understand that, yeah. In the lab growing and dividing, getting enough cells, and then maybe another week to ship, ship it to wherever it needs to go. So it is probably quite similar sort of lifespan from,

**Emma Blamont:** would it be some, would it be something eventually that you might be able to use stem cells?

**Dr Hannah Levis:** Yeah, so yeah, so currently we take cells from the don, which are technically adult cells, and we manipulate them in the lab so that they can grow. So we give them different nutrients and factors. But people are looking at you might have heard of induced pluripotent stem cells. So these are stem cells that you originate from maybe typically a piece of skin or another tissue [00:42:00] that you d differentiate, so send back so that they're less mature and then you, they become neutralized and then so they be, then they can push them in the direction that you want to become any type of cell that you like.

Relatively. And so these cells, it means that you can take cells from your own skin, grow them in the lab, and then turn them into eye cells, for example. You wouldn't have to worry at all about rejection because they're your own cells. They originate from your own cells. A lot of people are looking at using these for lots of different cell therapies and it is potentially, people have looked if they could create corneal endothelial cells from these.

Cells, but with every type of stem cell, there's lots of regulations surrounding their use in patients because they have many, a lot of potential to become different types of cells, they can also become tumor cells, et cetera. A lot more work is being done on testing and safety it, quite rightly before they go into patients and seeing if they [00:43:00] have really become the cells that we hope that they become.

But yeah, people are looking at using those symptoms and the therapy that we were looking at on the ocular surface, so the front surface of the eye, but on your front surface you have stem cells around the edge where it goes from white to clear is where the stem cells are that repair the front surface of your eye.

Every couple of weeks, all those cells are renewed. So we can exploit the eye stem cells as well to create different cell therapies, not just induced

**Emma Blamont:** Sounds fascinating. The future could be even brighter for us all. Brilliant. I think they're, no more questions. We'll probably wrap up. And so I'd like to thank you all for joining the webinar today. Thank you to Dr Levis, Dr. Romano and Peter for coming along and sharing.

If you enjoyed the webinar, we, our next webinar will be one on creating social communities where [00:44:00] we'll be joined by Sutton Vision, who we fund as part of our social change program. We also have a slide which will be provided with you with the information we'll send after the webinar, which provides further information on conditions requiring corneal transplant and Dr. Levis' project with Fight for Sight. And yeah, thank you once again for joining us. We hope to see you again for the next webinar. And yeah, please do answer the survey. Please do answer respond to the survey we send following the end of the webinar. Thank you all. Bye

**Peter Fenwick:** bye bye. Thank you. Bye.