2015 Medica/Compamed Exhibition
Dusseldorf – Germany

Design, Development and Manufacturing of Scalp Cooling Cap

Exhibition Narrative By:
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Messe Düsseldorf GmbH, Germany
16th – 19th November 2015

Exhibition Narrative:

Paxman engaged the expertise of researchers at two of the University of Huddersfield's academic schools. Initially funded by an **Innovation Voucher** from Kirklees Council, Paxman started working with the **School of Applied** Sciences, using its cutting-edge **cell biology** techniques to help identify the mechanisms that govern patients' variable responses to scalp cooling. Following additional funding from (TSB) and (KTP), at the University of Huddersfield, the **School of Art, Design and Architecture, a research team established and working with Paxman since 2012** to investigate the design an development of more efficient scalp cooling cap. [1], [2],[3],[4],[5],[6].

University of Huddersfield, Paxman Coolers Limited and Primasil showcased the output of a collaborative project that resulted in an innovative scalp-cooling cap at the 2015 Medica/Compamed Exhibition Dusseldorf – Germany. [7]. The scalp cooling cap is exhibited at the exhibition by both :

- **COMPAMED Hall 8A Stand R19 by** Medisil (Primasil) Limited
- **Medilink in** Hall 1, Room 112

Only 30 British companies were selected by Medilink including Paxman coolers. They have exhibited the new and previous caps to the event. This event is in collaboration with UK Trade & Investment, the British Trade Associations ABHI, Gambica and BIVDA. [8].

Medica/Compamed Exhibition Centre

Award winning Scalp Cooling for Paxman

Healthcare Trade Shows/Exhibitions:

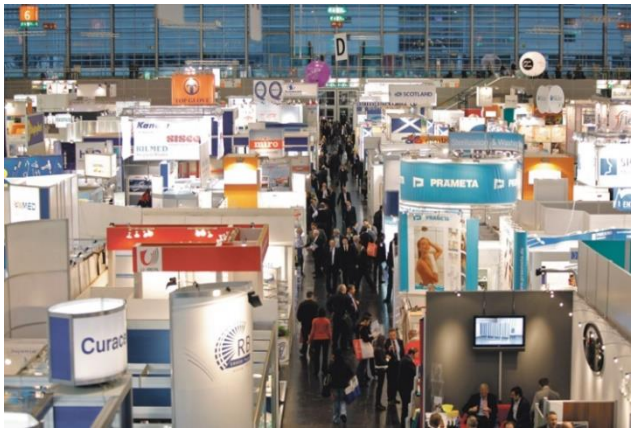
Healthcare trade shows provide tremendous opportunities to connect with professionals from different sectors of the industry, to learn about new technologies, tools, and methods being used by practitioners, and to market and exhibit new medical products and devices. The healthcare industry is one of the world's largest and fastest-growing industries encompassing a wide range of disciplines in a wide range of settings. Every year, hundreds of trade shows, conventions, exhibitions are held across the globe, gathering thousands of healthcare companies exhibiting and hundreds of thousands of visitors. Most developed nations spend more than 10% of their total gross domestic product on healthcare, which makes healthcare one of the most economically important and influential industries today.

The following list contains major medical exhibitions and fairs: Compamed/Medica from Germany, Dusseldorf; CMEF of China; MD & M West – USA; FIME – USA, Miami; Medtec (Europe, Ireland, France, China, Japan); Arab Health of UAE, Dubai; BONUS: Hospitalar of Brazil, Sao Paulo and also KIMES of Korea. [9], [10], [11]

Compamed /Medica:

Over 135,000 visitors from 120 nations come to Compamed/Medica in Düsseldorf, Germany where 50% were international visitors from the countries including the USA, Latin America, Iran and from the Arabic-speaking regions. The spectrum of innovations for out-patient and clinical care were offered by around 4,500 / 600 exhibitors at MEDICA / COMPAMED, respectively from 70 nations to experts from hospitals, practices, laboratories, the retail sector utilising over 115,000 m² of floor space. [11]

The MEDICA visitors were offered numerous innovations presented by exhibitors through the lectures and presentations that were being held at the MEDICA Connected Healthcare Forum including "wearables" and smartphones in combination with special health apps which can also be used by patients themselves have the potential of becoming an essential element of networked health in the future. The variety of devices ranges from lifestyle products, such as fitness trackers, to intelligent glasses and hearing devices, all the way to the latest trend – intelligent patches that continually retrieve physical data, but that can also administer medications in a minimally invasive manner.

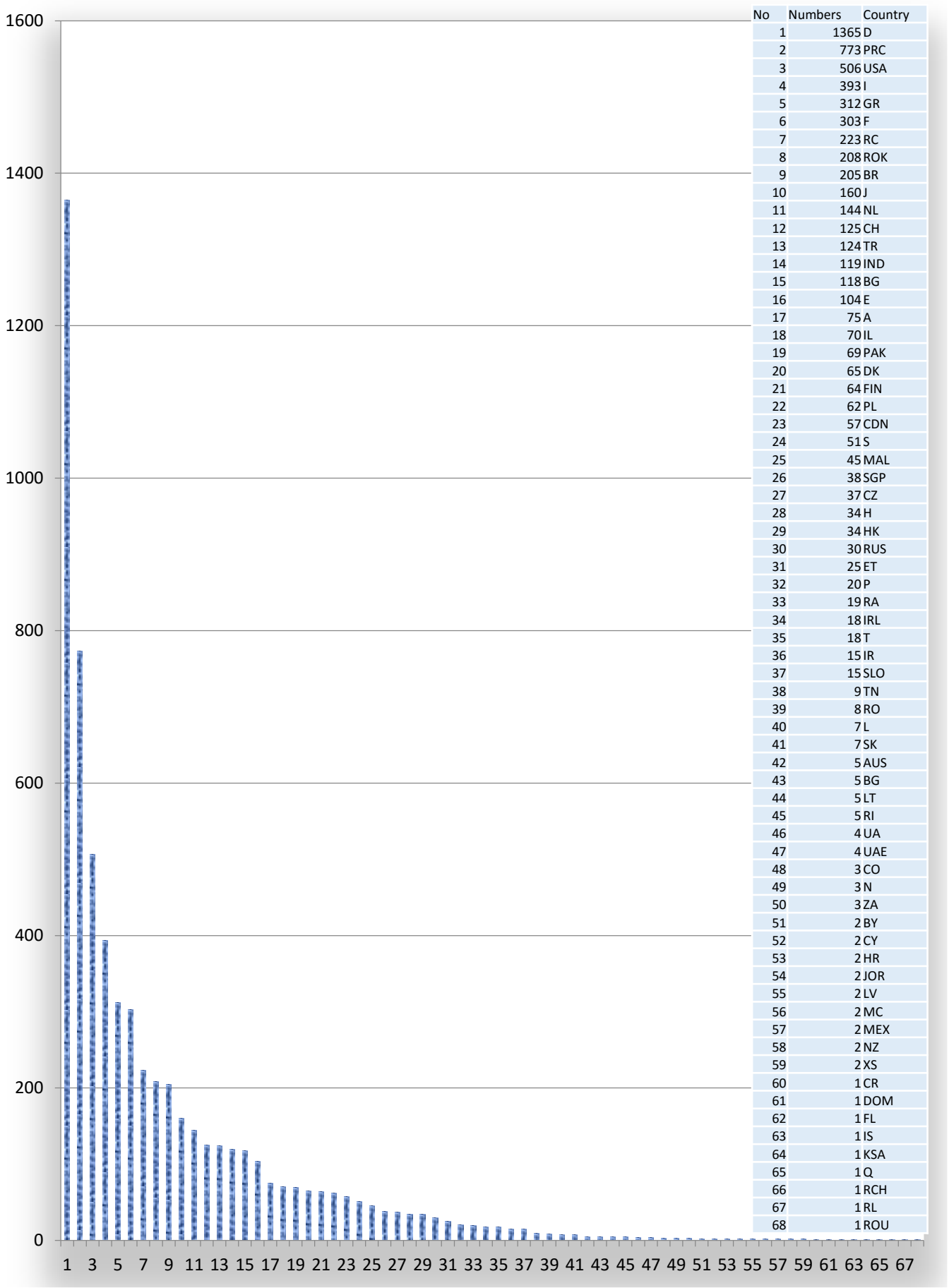


Medica/Compamed Exhibition Centre

During the conferences, medical technology innovations were discussed such as bringing an optimum level of benefit within the scope of the daily routine at many medical institutions. In particular for military and disaster medicine. Medica Physio Conference conceived especially for physiotherapeutic treatment concepts were as the Medica Education Conference, organised by the Germany Society for Internal Medicine and Messe Düsseldorf, offered many interdisciplinary and international programme highlights within the scope of 56 events with 168 speakers from Great Britain, the Netherlands, Sweden, Austria and Poland, among others. The connection between science and medical technology was the common theme of the presentations.

The graph below shows the distribution of companies from different countries. Germany, China, USA, Italy, UK, France were the largest exhibitors.

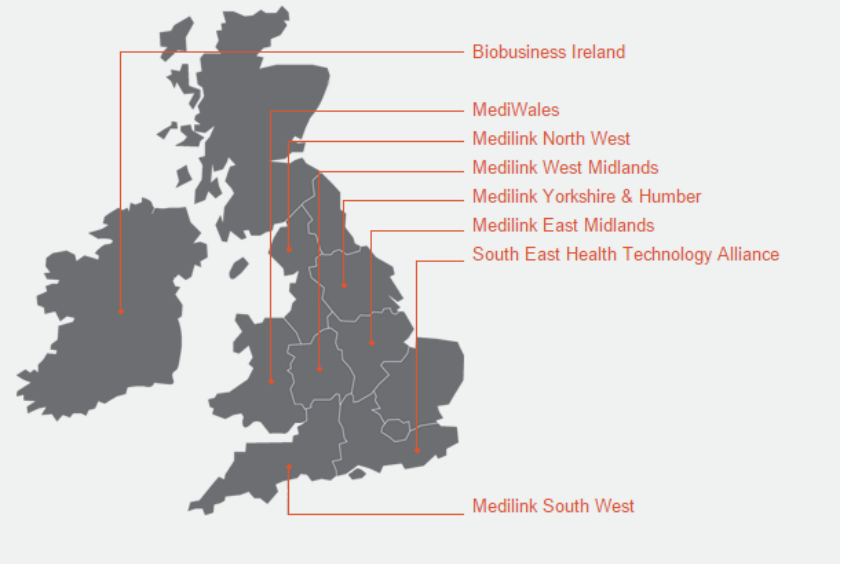
Number of Companies & Countries represented at *Medica/Compamed* exhibition



No	Numbers	Country
1	1365	D
2	773	PRC
3	506	USA
4	393	I
5	312	GR
6	303	F
7	223	RC
8	208	ROK
9	205	BR
10	160	J
11	144	NL
12	125	CH
13	124	TR
14	119	IND
15	118	BG
16	104	E
17	75	A
18	70	IL
19	69	PAK
20	65	DK
21	64	FIN
22	62	PL
23	57	CDN
24	51	S
25	45	MAL
26	38	SGP
27	37	CZ
28	34	H
29	34	HK
30	30	RUS
31	25	ET
32	20	P
33	19	RA
34	18	IRL
35	18	T
36	15	IR
37	15	SLO
38	9	TN
39	8	RO
40	7	L
41	7	SK
42	5	AUS
43	5	BG
44	5	LT
45	5	RI
46	4	UA
47	4	UAE
48	3	CO
49	3	N
50	3	ZA
51	2	BY
52	2	CY
53	2	HR
54	2	JOR
55	2	LV
56	2	MC
57	2	MEX
58	2	NZ
59	2	XS
60	1	CR
61	1	DOM
62	1	FL
63	1	IS
64	1	KSA
65	1	Q
66	1	RCH
67	1	RL
68	1	ROU

Medilink:

Medilink UK is a national health technology business support organisation, with a strong track record in increasing the viability of manufacturers, service providers, designers, OEMs and suppliers of medical technology. Medilink UK helps companies from concept through to commercialisation and nurtures collaborations between academics, clinicians and industry. With a team of experts, Medilink UK provides bespoke market research for companies diversifying into the sector, or investing in research and development. On an international platform, Medilink UK supports global companies investing in the UK market as well as promoting the export of products and services to the US, Middle East and Asia.



Medilink UK

Medilink Yorkshire and Humber is the membership based representative body dedicated to the growth of the Healthcare Technologies sector. Medilink brings together the NHS, academia and industry to stimulate innovation and support the growth of the Healthcare Technologies sector, providing specialist consultancy services around Innovation and Commercialisation, International Trade, PR and Marketing and Sector Skill provision. Each year Medilink Yorkshire & Humber (Y&H) – the organisation dedicated to the growth of the Healthcare Technologies sector. [12]

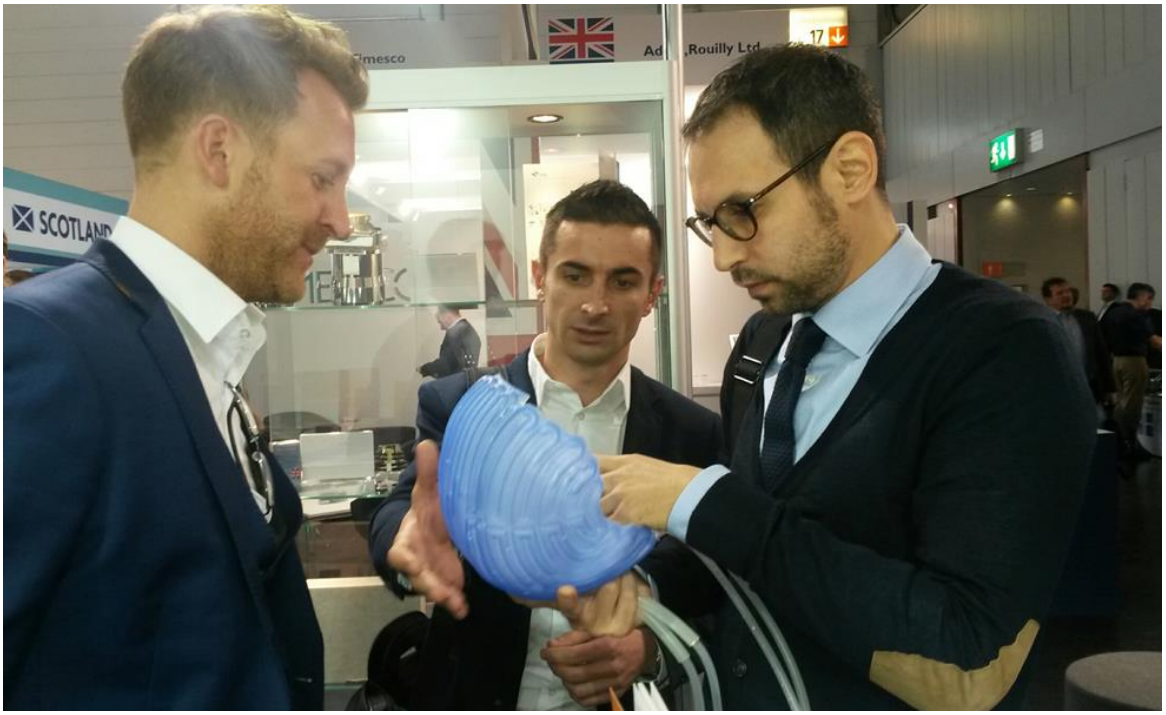
Yorkshire (UK) has a reputation for designing and manufacturing some of the worlds most innovative and pioneering Healthcare products and this is reflected in the wide range of medical devices being showcased at MEDICA the largest medical technology fair in the world. “Yorkshire and Humber is at the forefront of the UK’s latest advances in healthcare and one of the UK’s highest concentrations of medical device companies, from established companies down to smaller university spin-outs. Medilink stated that “MEDICA is a fantastic platform for innovation so it is great to see so many regional companies exhibiting their world leading products at the exhibition. Medilink supports the growth of the sector and by supporting Yorkshire companies at major international shows like MEDICA helps ensure the world’s healthcare sector is talking about Yorkshire’s innovation.”

Regional companies participated at MEDICA previously includes: Centurion Europe; Brenmoor; METRC; Paxman Coolers; Platts and Nisbett; Surgical Innovations; Tissuemed; Trio Healthcare; Tomorrow Options and Zilico.

EXHIBITION:

Paxman has been a member of Medilink for nearly 20 years. Medilink helps to establish Healthcare Technology network as they have a wealth of experience and expertise in the sector. They offer Innovation services to stimulate and drive new product and market opportunities; Bespoke PR and communications to promote brands through social media and press coverage; Opportunities for international development with the support of their dedicated team; Training and networking opportunities with other healthcare professionals in the region.

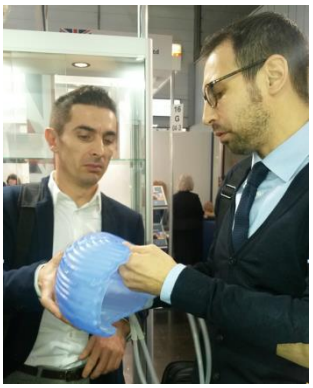
A Medilink delegation was present at the recent Medica & Compamed 2015 and the academics and Paxman team were delighted to have the Paxman scalp cooling caps showcased on their stand along with the products of other UK healthcare companies.



Paxman Director, Richard Paxman demonstrating the new cap at Medica & Compamed, Germany

Several of Paxman's global partners were able to view the new cap development for themselves, including their Italian distributor who are pictured above evaluating the new cap.

The visitors informed the Paxman team that they were extremely impressed with the new cap with regards to flexibility, weight, fit and shape.



About Paxman Coolers:

Based in Huddersfield, UK, the leading global manufacturer and supplier of scalp cooling equipment for cancer chemotherapy patients

The company's history dates back to the 1950s when the beer cooler was invented by Eric Paxman, the father of Paxman's current Chairman.

Glenn and his brother Neil built the first prototype of the cooling cap which was installed at the Huddersfield Royal Infirmary in 1997. [1]

What is Scalp Cooling?

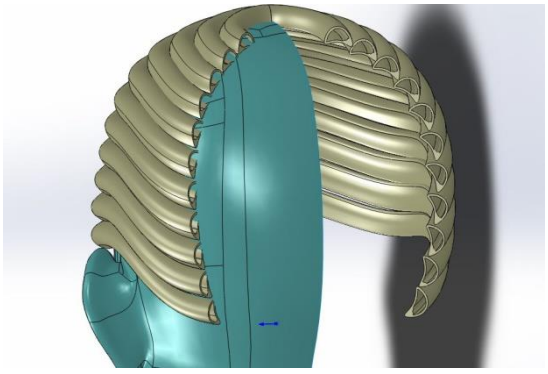
- Scalp cooling is a simple treatment that can prevent hair loss caused by certain chemotherapy drugs.
- The use of scalp cooling or 'cold caps' is proven to be an effective way of combatting chemotherapy-induced hair loss and can result in a high level of retention or completely preserve the hair. For patients, this means the opportunity to regain some control, maintain their privacy and encourage a positive attitude towards treatment. Further information see: [13], [14], [15], [16]

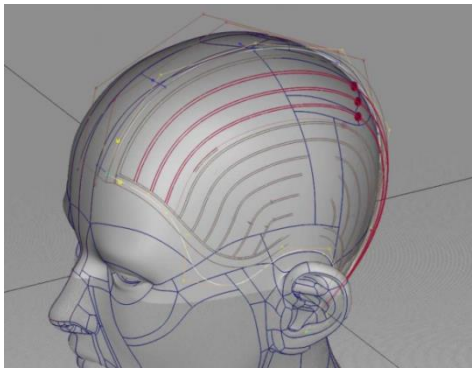
Scalp cooling system

Design Background:

The design skills and technical innovations of researchers at the University of Huddersfield have led to significant improvements in a silicon cooling cap that aims to reduce hair loss in cancer patients. Now their contribution to the project has helped earn an international award. The cooling cap has been developed, manufactured and globally marketed by Huddersfield firm Paxman, which has formed close ties – including highly successful UK Government-funded Knowledge Transfer Partnerships (KTPs) - with experts at the University, where scientists have established the scientific basis for scalp cooling in preventing hair loss during chemotherapy. And in the School of Art, Design and Architecture, lecturers Dr Ertu Unver and Dr David Swann have worked on major improvements to the design of the cap. [29]

The academic team worked closely with the firm Primasil Silicones in the creation of a silicone rubber formulation that gave the cooling cap greater flexibility and enabled the coolant running through the cap to be in close contact with the scalp. Scalp Cooling Cap Design was declared the winner of the Exhibitor Innovations Competition *Medtech World Awards*. [27]





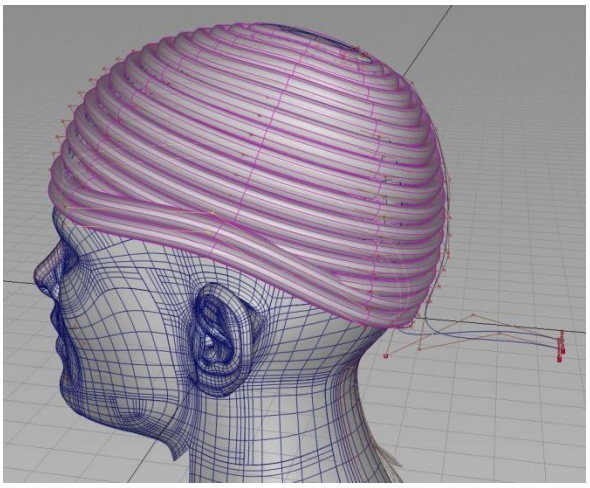
Design and Development Phase

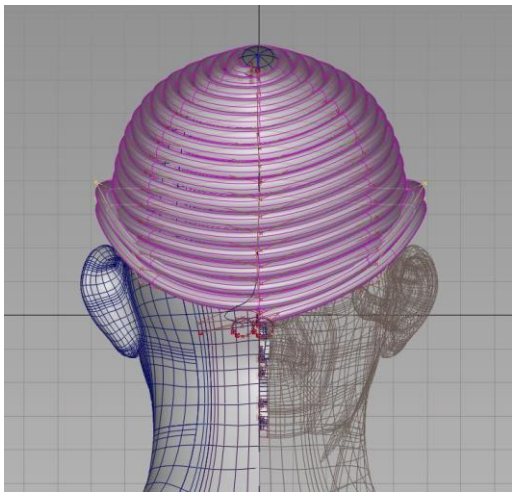
Design and Development of Scalp Cooling Device : Brief

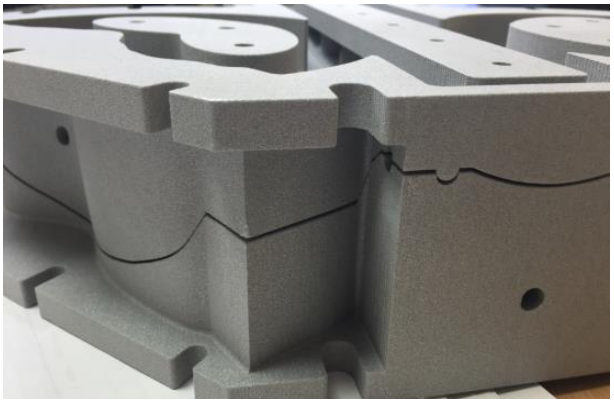
Dr Unver's brief was to redesign the cooling cap so that it is a better fit – vital if the device is to be effective – and can be mass-manufactured, making it more economical, aiding Paxman's global marketing drive. The cap that he and Dr Swann developed fits the head more efficiently, despite a reduction in the range of sizes from five to three. There has also been an improvement in the flow pattern of the coolant. During the project, Dr Unver carried out extensive research into head sizes and used 3-D technology to develop a new design. Then, 3-D printing was used to create a template for the production of cooling caps in silicon. He worked closely with Primasil and, in conjunction with the firm, two patents have been applied for.

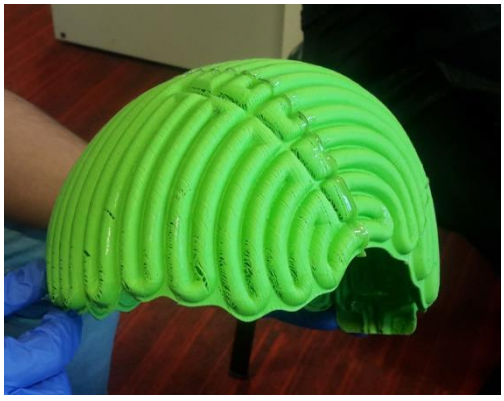
The cooling cap was also one of 46 finalists in the highly-prestigious INDEX: Design to Improve Life Awards, which received 1,123 entries from 72 countries [32].

Now the highly fruitful collaboration with Paxman will carry on, as the firm seeks to make continual improvements to its cooling caps. The latest development is a new KTP – part-funded by Government organisation Innovate UK – for which Dr Unver and Dr Swann are the academic and enterprise supervisors. The KTP associate who will carry out research at Paxman's Huddersfield HQ and at the University, is Chris Sorbie, a Product Design graduate and former student of Dr Unver. He will work towards a Master's degree during the KTP.









Design and Development Phase

Consideration, Research / Preliminary Testing:

- Preliminary Research into European/Far-East human head size/shape data and availability.
- 3D Scanning of the volunteer's head creation of 3D CAD model.
- Produce suitable method of cap design & tool design to suit supplier's production method.
- In collaboration with Paxman and the supplier the following objectives were agreed:
    - Improve Conductivity
    - Improve Cap Fit
    - Improve Patient Comfort and Ergonomics
    - Improve the Ability to Mass-Produce
    - Minimise the number of size options
    - Reduce Manufacturing Cost
    - Identify optimal flow pattern within the Cap Design
- Tooling Design for Silicone Moulding
- Investigate 3D printing for tool manufacturing
    - Non-metallic 3D printing
    - Metallic 3D printing
    - Coating
- Investigate Metal Layer Slicing method, laser Cutting, Rhino Grasshopper software programming
- Investigate Low Melting Alloys for tooling, mainly Bismuth

Images show various preliminary experiments, tests carried out to identify a sustainable, cost effective manufacturing method. See: [17], [18],[19],[20], [21], [22], [23], [24], [25], [26]

Manufacturing and Testing:

After a number of design iterations and testing of various moulding methods, 3D printing materials, a number of moulding tools created to produce prototyped at Primasil ltd which is the current research partner and manufacturer.

Prototypes and the final Cap

Conclusion:

After successfully producing a number of prototypes, and completing a number of local testing, the new cap recently been tested in a number of internationals hospitals and dealers. The team also produced the tooling for mass manufacturing for different size caps and recently started producing mass manufactured caps.

The scalp cooling cap project shows how collaborations between SME companies, Universities can work together to produce successful award winning products. The research also helped Silicone manufacturer Primasil ltd to become one of the leading Silicone manufacturer to use state of art 3D printing for their manufacturing process. Paxman coolers also have a product which was impossible to produce using traditional manufacturing methods in the timescale and budget .

Knowledge/skills capable of supporting community regeneration and which test University ideas/research. The final prototypes are currently being tested in a number of medical institutions in various countries including, UK, Japan, Russia. The Paxman coolers and University academics filed joint patent applications and further collaboration through Innovate UK KTP (Knowledge Transfer Partnership) research already started.

Primasil Visit: Team from Paxman Coolers, University of Huddersfield and Primasil Limited

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Acknowledgment and the Research team:

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