

Case study number: 10/2011

Project Title: R&D project – Knitted head strap for Pilairo breathing mask

TDL Partner: Fisher & Paykel Healthcare

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Project Period: April 2010 – October 2011

Partner Profile: Fisher & Paykel Healthcare (FPH) is an iconic New Zealand healthcare research and manufacturing company that exports globally. They have worked with AUT's engineering school, product design department and the TDL on numerous research and development projects.

Project background: Fisher & Paykel Healthcare initially developed a respiratory humidifier for hospital intensive care applications, which was further developed for home use. Breathing masks are often worn all night, for example, to regulate air flow for people with sleep apnea, so a good fit and the right amount of tension on the headstrap is very important. Since 2009 Fisher and Paykel Healthcare had tried many methods of developing the head strap that included the use of modified elastic, braided rubber and narrow weaving, but these approaches had problems. Fisher & Paykel Healthcare Product Group Manager, Andrew Salmon, found out about the AUT Textile and Design Lab through existing work with the AUT engineering department.

Project Description: Andrew wanted to know if the TDL could help them by developing a knitted elasticised head strap for a breathing mask. This involved the development of lengths of tubular knitted strapping that could be fully stretched multiple times without losing its elasticity. The other criteria included no sharp or ridged edges, they had to be sufficiently comfortable for people to use even while sleeping, and secure enough so that the masks would not leak air or become dislodged.

Project Methodology: A product brief was drawn up by FPH and communicated to the TDL technician, Gordon Fraser. Andrew Salmon worked closely with Gordon at the TDL, by phone and email. Gordon initially created a programme for the knitted strap using the Shima Seiki Knit software before knitting it on the Shima 041 accessory machine. Initial samples were made using a combination of nylon covered spandex with cotton and acrylic yarns. FPH tested the samples and worked with Gordon to develop different specifications and alterations. Andrew says this process “involved us getting samples from Gordon and testing them to see how much they would stretch, and how much force it took to stretch the strap open.” Gordon made straps of varying materials including nylon, elastic, polyester, wool and cotton in differing lengths, consistencies and designs. FPH supplied a nylon covered rubber elastomeric yarn which was tested independently as well as being knitted with cotton and acrylic yarns.

Several additional trials were subsequently knitted using various covering yarns around the rubber component. Knit structures were also varied to ascertain the most suitable permutations. Gordon developed a technique to knit 6 straps simultaneously on the 041 machine and programmed the final knit pattern manually. Productivity estimates were carried out by the TDL's technician so the unit cost could be calculated by FPH staff. The above project was accomplished over a 2 month period and FPH were satisfied that the final prototypes met the criteria in all respects. During this process, FPH's engineer, Rex Faithful, became familiar with the Shima Seiki knit technology through working closely with Gordon. Once satisfied that the final product would meet FPH's stringent

criteria, the company placed an order for their own Shima Seiki 061 knitted accessory machine for the mass production of these straps.

Feedback: Andrew found working with the TDL “really good”, saying Peter Heslop, the TDL’s manager, and Gordon Fraser were very helpful and that “they gave us what we asked for”. Andrew was impressed with Peter and Gordon’s availability for questions and feedback and the way they synchronised their schedule with FPH’s needs. Andrew’s feedback was very positive saying the partnership was “ideal”.

Conclusion: The TDL helped develop a successful product that F&PH has since adopted and continues to produce commercially. FPH gave excellent feedback about the TDL’s schedules, working practices, technology, training, expertise and staff. The TDL is proud to have supported FPH during the course of this R&D project, and in so doing, has helped to further build the capability of a high profile New Zealand manufacturing company. The TDL continues to support FPH with technical assistance and consultancy.



The TDL’s Shima Seiki 041 knitted accessory machine



*The finished article – F&P’s ‘Pilairo
respiratory mask*

Further resources: Fisher & Paykel Healthcare Respiratory website:

<http://www.fphcare.com/respiratory-acute-care.html>

These forum posts subjectively and clearly show how important respiratory masks can be, and how important the right tension is for comfort and sleep ability:

<http://forums.webmd.com/3/sleep-disorders-exchange/forum/802>