URINARY INCONTINENCE AND THE PRACTICE OF WATER SPORTS – DEVELOPING A SWIMSUIT SOLUTION

CAMILA FALCON[1], CRISTINA BROEGA[2]

[1]*University of Minho, Centro de Ciencia e Tecnologia Textil, camila.karp@gmail.com*

[2]*University of Minho, Centro de Ciencia e Tecnologia Textil, cbroega@det.uminho.pt*

***Abstract**: This paper aims to present the development of some design proposals of swimsuits destined to people who suffer from urinary incontinence. The incontinence is a clinical situation that affects a big number of people worldwide, because of this problem they are abstain to practice water sports and hydrotherapy treatments. This investigation studies the clinical problem, also the research about the existing products on the market and the textile materials for swimsuits, and tries to give a functional answer to the problem ensuring also a good aesthetic appeal, which normally is absent on the products available in the market. Thus is proposed six models of products combining inclusive design, functionality and aesthetic appeal.*

***Keywords**: swimsuits; urinary incontinence; comfort; design*

1. Introduction

This article aims to present the design of a swimsuit to people who suffer from urinary incontinence. Loss of control of urine is a condition that millions of people suffers around the world. People suffering from urinary incontinence have difficulties to enjoying hydrotherapy treatments, which is a resource that has been increasingly used in the medical field. There are already many products for incontinence available on the market, but these products are not effective against the loss of urine inside water. One of the main features proposed for this swimsuit, is to allow the absorption of involuntary loss of urine and ensures the sealing of liquids in the junction zones of the body in order to prevent leakage of liquids but always focusing on the comfort parameters of the user. It aims to combine the functional and technical parameters of the materials with the aesthetic characteristics, in a way to not stigmatize these patients.

The methodology of product design used, studies the user needs and the physiological characterization of urinary incontinence, which will help define the technical, aesthetic and functional characteristics of the swimsuit. The study includes a research of the products available on the market and a characterization of various raw materials to be used in different parts of the swimsuit. The first layer next to the skin; the absorbent materials layer; the impermeable materials and sealing materials for liquid junction areas around the legs and waist. The work also includes the aesthetic design of the products being developed.

1.1 Urinary Incontinence – identification of the problem

According to the International Continence Society (ICS) Urinary Incontinence, is defined as any involuntary loss of urine. It is a pathological condition resulting from the inability to store and control the output of urine. These losses are presented in diversified manners. Can range from mild and occasional leakage, to the most serious and regular urine losses, according to the Portuguese Association of Urology (PAU). The World Health Organization in addition, define Urinary Incontinence as a difficulty in controlling the involuntary loss of urine, still salient that it is a matter of hygiene with personal and social impact. Urinary incontinence is transverse to society in both sexes and all ages. The loss of urine control is a common condition experienced by millions of people, however, according to the Portuguese Association of

Urology women are the most affected. Currently, 33% of women and 16% of men over 40 years have symptoms of urinary incontinence.

There are different types of urinary incontinence, as follows:

a) Urinary Incontinence by effort: consists in the involuntary loss of urine associated with effort or physical activity, such as coughing, sneezing, laughing, climbing stairs, running, among others;

b) Urinary Incontinence by urgency: is the involuntary loss of urine associated with a sudden and strong urge to urinate (includes from small losses to a loss that leads to complete bladder emptying). The bladder has sudden contractions, causing urgent urination. This type of incontinence may be related to aging, but also emerges in younger ages, associated with neurological diseases or non-identifiable causes;

c) Urinary incontinence "mixed": is the involuntary loss of urine associated with both, the effort and also with a sense of urgency;

d) Continuous Urinary Incontinence: is the continuous loss of urine.

The main symptoms of urinary incontinence, according to the Portuguese Association of Urology (PAU), may be beyond the loss of urine involuntarily; it is also the urge to rash into the bathroom with the fear of not arriving on time. Also when leakage occurs during coughing, sneezing, or lifting a heavy object. Need for diapers to absorb urine leakage. Limitations of daily activities, for fear of having urine leakage. Leakage path to way of the bathroom. The need to make several visits to the bathroom, to avoid leakage. Difficulty in starting to urinate and a need to urinate more than twice a night.

According to Norton & Brubaker (2006), there are over 200 million people worldwide who suffer from urinary incontinence. In Portugal there are about 650 000 people suffering from this problem, mostly women, but some of these patients hide this limitation by shame or because they assume that the natural Urinary Incontinence is a problem caused by the increasing age and thus do not seek for clinic help.

In 2050, the elderly population is expected to increase. Associated with this demographic change is expected to increase by 55% of women with urinary incontinence, according to the Portuguese Association of Urology. According to the International Continence Society (ICS), in addition to being a health and hygiene problem, loss of urine is a situation that affects social and personal levels. There is a belief that urinary incontinence is a process that is part of aging, which makes it often difficult to be spontaneously reported by patients. The Urinary Incontinence removes quality of life for these patients, causing some labour and social limitations, and because of social isolation, frustration, anxiety can even lead to a state of depression.

People with Urinary Incontinence problems cannot benefit from the use of the hydrotherapy treatments. Hydrotherapy currently is a physical therapy resource that has been increasingly used in the medical field as an extra resource to obtain a faster recovery in skeletal-muscle diseases. The movement in the water is carried out more easily than on land. The effects of turbulence and flotation combined with warmness help reduce pain and muscle spasm, promoting relaxation. The water stimulates the skin, eyes and ears, tending to promote the senses for the activities, together with the touch and the security offered by the therapist. Furthermore, hydrotherapy provides joy and pleasure, which enhances confidence and self-esteem of the patient, making these complementary aspects in the rehabilitation program.

2. Requirements for product development

2.1 Swimming suit features (for incontinence's)

The main feature of the product is the capacity of absorption of urine without allowing to leak into pool water. Must combine functionality to aesthetic appeal, to be discreet for the user in a way he doesn't feel stigmatized to other people. The product is intended to be used in water sports and activities such as swimming, water aerobics and hydrotherapy treatments, in public and private pools and even at beaches.

The first products conceptions are aimed for women, after prototype, and testing can be considered developing versions aimed at male and child.

2.2 Specification of the functionality

The product must respond the following requirements:

- Liquid absorption
- Sealing liquids
- Ease of movement
- Flexibility
- Security
- Comfort
- Aesthetic appeal
- Durability
- Discretion

3. Solutions for incontinence products available on the market

There are some products to support incontinence´s available on the market, from adult diapers, with different absorption capacities, to incontinence pads of various sizes. There are products for everyday use, which, ensure to absorb urine, compounds of protection systems with flakes of superabsorbent gel, fluid diffuser, anti-leak barriers, among others. Also washable and reusable undergarments, which claim to guarantee the urine absorption.

Regarding products for use in water sports such as swimming or hydrotherapy there are a few options in the market, but there is no evidence of the effectiveness of these products in contact with water leakage, and ultimately provide better efficacy in fecal incontinence and not in urinary incontinence. There are a large variety of underwear and diapers made of plastic or latex materials, disposable and reusable. This type of product can be effective for fecal incontinence, but do not present liquid sealing, and that these plastics materials may cause allergies in contact with the skin. Overall the existing products on the market do not have a nice aesthetic appeal for users or the comfort and discretion necessary for people with incontinence to feel comfortable on practicing sports or pool activities.

Figure 1: reusable diaper Label: “SOSecure” (http://sliponswimsuits.com/sosecure/)

The label “SOSecure” developed a reusable diaper (Figure 1) that is composed of a waterproof finish polyurethane. It has elastic in the legs and waist and Velcro closure. As presented in Figure 1 can be used underneath the bathing suits, but also does not have some sort of sealing liquid (only elastic, but there is no evidence of efficacy). Also have very thick materials that end up not being discreet underneath the swimsuit.

Figure 2: Swimsuit incontinence brand Suprima (http://www.suprima-gmbh.de)

The brand “Suprima” developed the swimsuits shown in Figure 2, there are the adult versions for ladies and men and also infant boys and girls. The swimwear is designed with polyamide elastane and has waterproof polyurethane finish. Presents a sort of adjustable elastic seal with inner and silicone, but does not present any absorbent inside. The swimsuit must be used over the conventional diapers. It is indicated for persons with an ostomy, so has an internal pocket. The women's version has a kind of skirt over the swimming suit, compromising the product aesthetic appeal.

Figure 3: Swimsuit incontinence brand Kes-Vir (Source: http://www.kesvir.co.uk)

The “Kes-Vir” brand developed a swimsuit for ladies, men, and children who suffer from incontinence, have absorbent layers, waterproof liner through a polyurethane finish, and internal adjustments in the legs and waist by elastic. It is more suitable for fecal incontinence, and not for urinary.

We can notice that none of these products have full efficacy against incontinence, in order to allow safety and comfort. Thus the importance of this study, is to solve the problem that incontinence sufferers in aquatic and hydrotherapy sports practices (or lack of these). Recovery of inner wellbeing, and with this the self-esteem, comfort and safety are the goals of those who produce this kind of products, in order to return to the incontinent the possibility of living their everyday lives with complete normality, which is defended by the Portuguese Association of Urology.

4. Characterization of textile materials and layers

The characterization and selection of textile materials for the development of the swimsuit, was made through the research of products available in the market and textile raw materials for swimsuits and reusable diapers.

The main raw material for the outer fabric of the swimsuit proposal is the composition of 80% Polyamide and 20% Elastane, this kind of knitted fabric is widely used in beachwear and swimwear because it offers a good flexibility, durability, comfort and allows the implementation of coatings and finishing's.

The seams of the swimsuit are the "thermobonding seam". In order to block the entry or leakage of liquids, such as high performance swimsuits, as well as the diving-suits and surfing-suits.

4.1 Absorbent materials

For the absorbent materials used in the first layer in contact with the skin is proposed the use of bamboo fibbers fabric, because it is a material widely used in cloth diapers, it has good absorbent and quick-drying characteristics. The bamboo fabric according to Alves & Ruthschilling (2007) presents antibacterial properties, it is hypoallergenic, and odder inhibitor. It is also a fabric with a very soft and comfortable touch, more than cotton. It is a good choice because, being naturally antimicrobial, does not require any extra special finishing. Some reusable diapers for babies are made of this material.

4.2 Materials that act as watertight barrier

To ensure that the liquids do not mix or leak is important that the swimsuit present tightness in the legs area. In this case is suggested the application of a PTFE (polytetrafluoroethylene) membrane laminated and applied at the bottom of the swimsuit to the waistline, as it is one of the main parts where it should block the leaks. It is a hydrophobic, breathable membrane, similar to the chemical composition of the Teflon[1] with microperforations. These perforations are usually 20,000 times smaller than a drop of water, and higher than vapour molecules, allowing perspiration. It can be applied to almost all types of fabrics, and these membranes may also prevent the entry of bacteria (Clarke and O'Mahony, 2007).

4.3 Sealing materials for liquid junction zones terminals in the legs and waist

The material for the liquid sealing is more complex to achieve is suggested an application of silicon band to areas of junction in waist and legs. It is a temporary way to block the entry of water into a swimsuit without leakage of urine into the pool. The clothing for cycling has a silicone tape around the leg as a form of security to maintain the shorts in place; it is a bit tighter around legs and waist to achieve leaking prevention. The finishing in Silicon presents water repellence and good flexibility (O'Mahony and Braddock, 2002).

5. Product Proposal

For the product design is presented some options for female models. From the point of view of human physiognomy and the product requirements, it is important that this has a cut-out on the belt line, and below this, in order to be a contour line adjusted to the body, application of silicone as sealing. It will be necessary for the contour line of the thigh, where it explores a model with a more cut and dug a model with a little leg, thus trying to combine the human ergonomic features with sports movements, and the need for product sealing. The membrane that ensures impermeability of the product is applied only at the bottom of the swimsuit to the lines of cuts.

[1] Polymer polytetrafluoroethylene (PTFE), a registered trademark of DuPont.

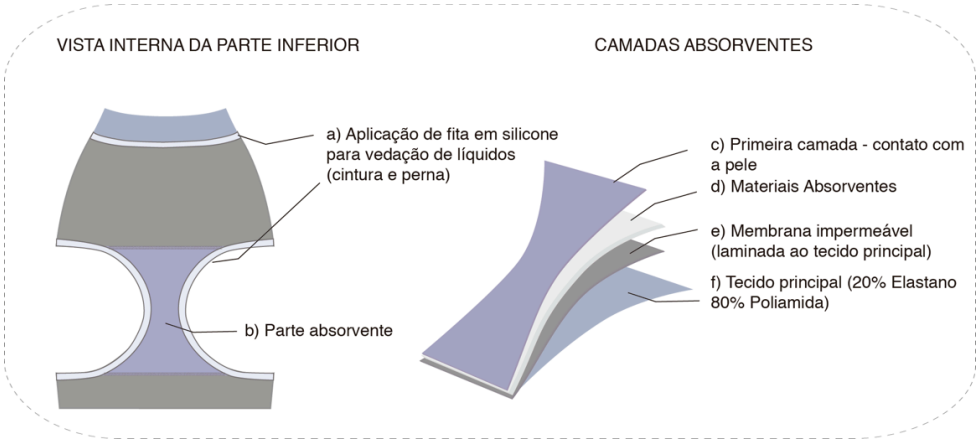

Figure 4: Simulation of the inside of the absorbent layers and leak swimsuit

Figure 4 shows the inside design of the swimwear. Point a) indicates where the silicone is applied, waist and thigh contour line. The zone b) indicates where the absorber is positioned. Already in the image detail point c) shows the first layer in contact with the skin, the d) the absorbent layers, part e) shows the impermeable membrane, and the part f) the tissue outside the main swimsuit.

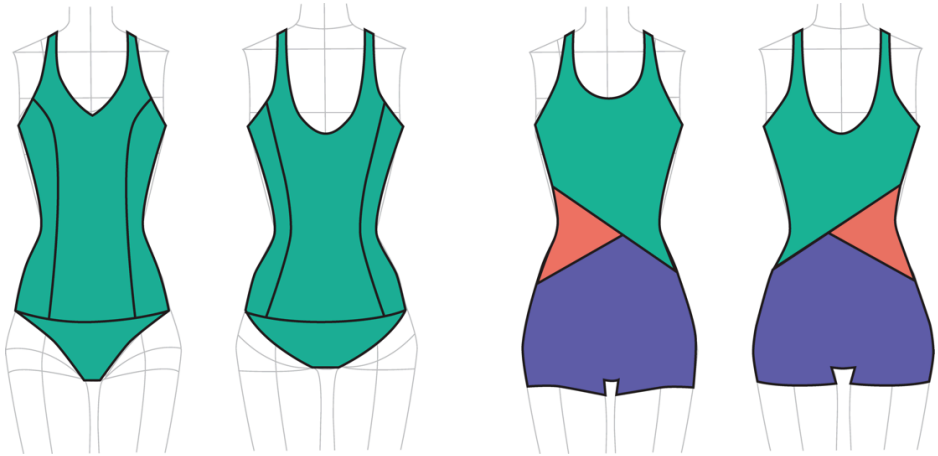

Figure 5: proposal of models 1 and 2 (front and back, respectively)

Figure 6: proposal of models 3 and 4 (front and back, respectively)

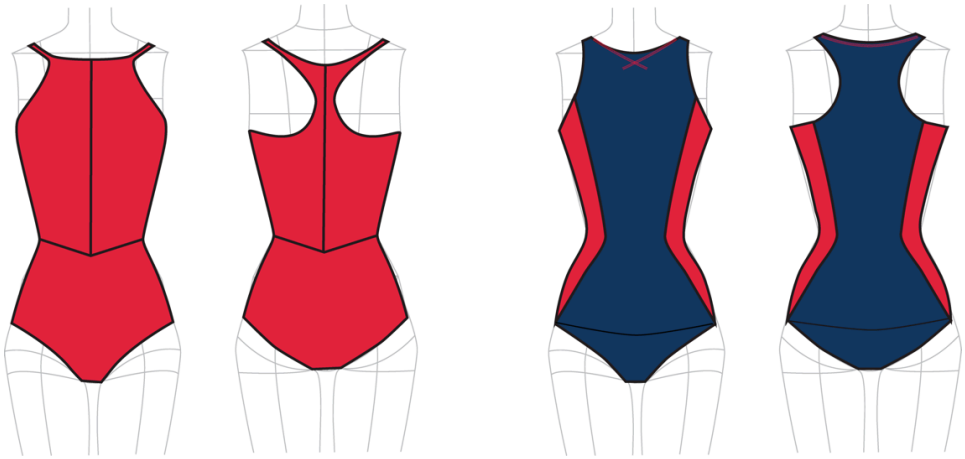

Figure 7: proposal of models 5 and 6 (front and back, respectively)

Regarding ergonomics and product patternmaking one of the important points is that the back neckline of the swimsuit is not too dug, the ideal is to stay above the waist line, for protection and less chance of leaking occur by cut-outs or edges of the swimsuit. Another important factor is the bikini line, not being very deep, to ensure better adhesion to the skin in the thigh in order seal liquids. As mentioned previously the models present a cut-out at the waist or bust for the insertion of silicone strip, and PTFE membrane at the bottom of the swimsuit.

In relation to the aesthetic appeal of the product, it was developed models with vertical cut-outs in order to elongate the figure as shows model 1 of Figure 5, and the model 5 of Figure 7, these cut-outs value curves of the body. Also clippings with contrasting colours as model 6 of Figure 7, which help slim the waist and shape the body and modernize the swimsuit. Geometric cut-outs as model 6, gives the impression of a more slender and elegant silhouette. Models 5 and 6 of Figure 7 show the back neckline style swimmer and model 3 of Figure 6 cross handles, widely used in swimsuits because they are comfortable and proper for arm movements to practice swimming. The handles of the models 1 and 2 of Figure 5 and model 4 of Figure 6, they are wide in order to guarantee a good support of the breasts and the neck-back in the "U" shape are also comfortable for movement activities.

The light or bright colours at the top of the models and dark at the bottom brings a visual balance. The darker shades, also help to disguise the volume of the body, because the absorbent layers of the proposed product. Therefore all models feature shades distributed that way, or monochrome models as one model of Figure 5 and model 5 of Figure 7, which lengthen the silhouette.

6. Conclusions

For the success of this study is important to ensure that people who suffer from urinary incontinence can practice sports and other water activities without worrying of incontinence problem in order to feel more secure and confident in a swimsuit that does not stigmatize them and that pleases them aesthetically.

Today new technologies in the production of finished textiles and coatings, can be used for various applications. This study involves the stages of new products development, exploitation of traditional or non-textile technologies, or often applied outside its traditional process.

The study is in the prototyping phase where some constraints are being solved, the next step is the testing of the product in patients suffering from incontinence, where they hope to achieve improvements in the product of participatory design in collaboration with the users themselves. As a result of this project is expected to validate the final product, taking into account not only the performance but also the properties of the physiological and psychosocial comfort level.

References

Alves, G.J.S., Ruthschilling, E.A. Vestuário Convencional: Aplicação e Comercialização de Eco-Têxteis, Proceedings of Colóquio de Moda, (3 Ed.), São Paulo, september, 2007. [Online] Available at: http://coloquiomoda.hospedagemdesites.ws/anais/anais/3-Coloquio-de-Moda_2007/8_14.pdf [Accessed: 2014-04-26]

Associação Portuguesa de Urologia. Incontinência Urinária, 2013. [Online] Available at: http://www.apurologia.pt/incontinencia/incontinencia_2013/Dossier_Imprensa_Incontinencia_Urinaria.pdf [Accessed: 2014-03-15]

Clarke, S.E.B., O'Mahony, M., 2007. *Techno textiles 2.* Thames and Hudson, London.

Gomes, P: Incontinência Urinária Feminina, Associação Portuguesa de Urologia. [Online] Available at: http://www.apurologia.pt/publico/frameset.htm?http://www.apurologia.pt/publico/incontinencia_urinaria_feminina.htm [Accessed: 2014-04-24]

International Continence Society (ICS). [Online] Available at: http://www.ics.org/ [Accessed: 2014-02-26]

Norton, P.; Brubaker, L., 2006. *Urinary incontinence in women*. Lancet.

O'Mahony, M., Braddock, S.E., 2002. *Sportstech: revolutionary fabrics, fashion and design*. Thames & Hudson, New York, NY.