Changes in Female Body Shape and its effect on the Intimate Apparel Industry

Abstract

With the well-documented changes in women's body mass index, the future consequences on intimate apparel fashion design cannot be ignored.

The theories of fashion may be complex and diverse, but the rapidly increasing average weight of the wealthy western woman may force the return to a curvy fashionable female shape, and since mildly overweight people live longer than those who are too thin, they have more time to enjoy their wardrobe.

Recent size surveys in the UK and America have identified body shapes that do not match intimate apparel manufacturer's block patterns or size charts, thus substantially reducing sales and customer satisfaction.

Linking closely to this increased and reshaped body size, is the comfort factor.

A trim figure type does not require the engineered fit of her plus sized sister and is unlikely to suffer the abrasive, posture-disturbing outcome of intimate apparel designed to reproduce a fashionable silhouette.

Reproduction corsets have run their course so it becomes the task of new technology to offer a pathway between fashion, comfort and shape.

The massive worldwide success of the molded cup bra is a fitting example. It does not relate to any fashion theory, aside from its seamless outline, it is a great camouflage device for every woman. It disguises asymmetric body shapes, smoothes fullness or encourages the ego and provides the best business corporate shape. It will be this type of 'need to wear' fashion design that will promote the extension of seamless, fused, smart fabric constructions into the new 21st century underwear and performance shapewear.

Introduction

The latest UK government's report forecasts that 70% of the UK population will be overweight within 20 years. The word 'somatotype' refers to the human body shape, and is used in the system of classification of human physical types. W.H. Sheldon, the American psychologist also described endomorph as the body type that tends towards roundness, and is distinguished by a globular body and a great deal of body fat, especially in the abdomen, upper arms and thighs.

Recent well documented size surveys in the UK and America have identified body shapes that no longer correspond with commercial block patterns and size charts. This comes as no surprise when one considers how historically this has come about, our dependence on cars, sedentary office work, increased time on computers and TV, and a diet of ready made fattening foods.

More than for any other item of clothing, sizing for intimate apparel is the most complex. As the human body changes towards endomorph, the normal considerations of dimensions, proportions, and posture change dramatically. Other factors that need consideration include fabric properties, comfort and fit preference.

This situation has thrust stretch control shapewear into a sudden fashion trend. For the last 25 years it has been a specialised market with limited sales. Noticeably, the last five years have exposed a small but growing interest in the product.

Senior lingerie buyers at Marks & Spencer now claim the market is entering a new era. "There are some fabulous products around to make you slimmer in seconds. "Years ago, support underwear had a dowdy, old-fashioned image. But it's not like that anymore." (Grazia magazine 29th October 2007)

On the basis that M&S are reputedly selling five pairs of support pants a minute, their enthusiasm for the product is well founded. (Daily Telegraph 7/11/07).

Grazia fashion magazine (29th October 2007) reported that shapewear is the fastest selling lingerie in the UK. Reports reveal that an overall boost in sales on last year of 312% while John Lewis reported a 22% increase in sales last month.

Online underwear specialist's Figleaves.com had to set up waiting lists until they could arrange more deliveries. As a fashion trend it is not the very large end of the female population that provide the largest market for shapewear, but UK dress sizes 14 and 16. What women appear to want is a waist and so the potential for massive sales in this market are inevitable

History

The Foundations of Sizing for Intimate Apparel

> One of the most interesting aspects of the history of the costume is the continuous evolution of the silhouette. This changing silhouette is not mere caprice on the part of the wearer, but can be traced to various origins, the most important perhaps being that clothes of any period belong to, and form part of, the greater whole of the architectural and economic background against which they are worn; they must also adapt themselves to the texture and design of the materials produced at the time; and, of course, there is always the human element-the primitive law of sex attraction. (Norah Waugh 1954)

Prior to the nineteenth century, body measurements were not taken to produce corsets, but rather used unpicked old garments. One of the few remaining books exemplifying this states, ‘unpick an old dress that fits well and lay your new lining on the cutting board with an old body on top’. (A. Adams 1853)

A garment would be fitted by dressmakers onto the corseted figure, modifying it for the different shapes and sizes. This became a ‘block’ pattern suitable for the fashions of the day. We read ‘a few dressmakers’ manuals began to include a list of standard measurements for one example bust size. It appears that it was almost the end of the seventeenth century before dressmaker’s drafts included a table of proportionate measurements.’ (Aldrich 2007)

More complicated garments for both men and women, including corsets, were made by tailors. Their patterns were drafted based on garment measurements, but body proportions and certain measurements were indicated. For this, notched parchment strips marked on proportional points intervals were used. The proportions of the breast and back lengths formed the basis of this system. Unfortunately, a new block would need to be created each time the corseted shape changed.

‘It was the study of anatomy, the mathematics of body proportions and its application to pattern drafting that was to bring about the most important contribution to the development of standard size’ (Aldrich 2007)

As early as the sixteenth century, garments had been made by tailors from patterns as can be witnessed in the tailoring pattern book of De Alcega, J (1589) Libro de Geometrica, Practia,y Traca,Cafa de Guilterme, Madrid)

By the eighteenth century, a system for drafting patterns had commenced. However, according to Aldrich, certain elements had to be in place for standardising clothing for the growing urban population. There were:

- The use of stable units of measurements (the inch and the centimeter)
- Theories of cutting based on systems of measurement.
- Methods of grading patterns based on body measurement proportions
- Technological developments

(Aldrich 2003)

Basic landmarks on the body for drafting and sizing were established through additional body measurements being recorded and refined. Patents were taken for measuring apparatus.
The ready to wear trade was to become dependent on the data of measurements for a large scale sizing system to be successful. The demand for systems of sizing grew in line with the requirements of ready to wear clothing.

The early twentieth century saw women no longer restricted by tight corsets. Nevertheless the breast still needed to be supported. Before the bra, corsets had been the means of support for the breast. Hence, it was from the dress block that the bra pattern and sizing was developed.

At this time, bra sizing had been rudimentary. There was a standard size, one smaller and one larger. However, by 1915, bust measurements were beginning to be recorded in inches. ‘Research in Australia in 1926 by the Berlei brand, found that women fell into five basic figure types. This heralded their launch of the ’Berlei Figure type indicator’ which formed the basis of their fitting schools agenda’ (Lingerie Buyer March 1992 p 16)

Although a woman would know which figure type she was, she would still have to be individually fitted for her intimate apparel. The corset manufacturers provided this service by establishing fitting schools. One of the most famous was the ‘Camp’ courses of instruction who recognised three basic figure types.

- Normal or average figure with a difference in measurement between waist and hip of about 10 in.
- Hip heavy types with a difference up to about 8 in.
- Top-heavy types with a difference down to about 6 in.
- Each of these types may be divided into three trunk lengths–short, medium, and tall.

(Camp Fitting Course Handbook, 1953)

In 1935, Warners concluded from their research that women measuring the same full bust measurement, could vary in the shape of the rib cage and breast fullness. As a result they developed their 'A B C D' alphabet brassieres, A being small; B being average; C being heavy and D being a very heavy breast. This catagorisation of cup sizes therefore gave a better fitting bra.

This revolutionised the contour fashion industry. It increased sales, simplified merchant's stocks as well as giving a better fit (The 'Warner' Brothers Company, 2nd Edition, 1951)

The Utility Scheme introduced during the second world war in 1940, authorized a streamlining of manufacture and prudence in fabric selection and economy in its use. For the first time, because of uniform production, sizing and costing was regularised and labour re-assessed. This was followed in 1951 by a national survey of women's body sizes and, until the recent size survey, was the one on which today's sizing systems have been based. Unfortunately, recent changes in bodyshape are accelerating. 'In the past decade alone the Western women's waist has increased by two inches to an average of 33.5inches.' (Daily Telegraph 7/11/07).

The SizeUK measurement survey showed that the average UK woman was a size 16, but according to a Mintel's survey, the average reported dress size is 14, suggesting that women are either buying clothing that is one size too small for them, or that they are under reporting their real size to save face.

Perhaps this is being unkind to female shoppers, since they are comparing themselves to a measure that itself has changed recently as many retailers have recently reappraised their sizing to make it more generous. Thus a 14, for instance, has often become closer in its

dimensions to what was in the past a 16. ‘In interviews, one retailer admitted it had made its sizes more generous to flatter its customers.’ (Lingerie Buyer. April 2006)

The introduction of rubber thread into intimate apparel at the beginning of the 20th century was a turning point in the design of shapewear garments. They relieved the pressure on the body that the traditional boned woven corset caused and fitted neatly into the new role of the working woman during The First World War and the following softer fashions of the next 20 years. In early corset designs, the rubber yarn was knitted into panels and used as a flexible area in the corset offering body suppleness and comfort.

The first synthetic fibre to play a role in corset development was Lastex, a trade name for an elastic, two-way stretch textile made from Latex, a chemically modified rubber. Lastex was introduced around 1925 and was quickly incorporated into corset fabric to give it stretch, revolutionizing their design.

Gradually, the weight of the corset was reduced, the number of metal bones were reduced giving a softer handle and further improvements to flexibility. For the first time in three centuries, the corset could now be regularly laundered. Rubber was now the new control fabric and it offered the plasticity to make the ‘Roll On’. This midrift control garment fitted very tightly, the recommended method of entry was to dust the inside of the ‘Roll On’ with talcum powder, lie on the bed and cross the legs whilst easing the body into the sheath of rubber.

Spandex, a synthetic fabric invented by DuPont in 1958, and marketed by them under the brand name Lycra, was a very stretchy material that was thin, strong and lightweight, Spandex can be knitted into a fabric that can be made to stretch on only one or on both axes. The result is a fabric that produces a form-fitting garment that hugs the body like a second skin. It is also called elasthanne. Spandex was used for the corselette, a popular control garment design, featuring both stretch body control and bra cups, in one garment.

As skirt lengths became fashionably short in the 1960’s, control garment designs incorporated legs and crutch fastenings and became known as the pantie girdle and pantie corselette.

Current designs

Fashion designers have often dominated and over-emphasized the silhouette of clothing without understanding the technical requirements for foundation garments to support them. The rapidly increasing average weight of the wealthy western woman may force the return to a curvy fashionable female shape and the current resurgence of shapewear will develop this type of 'need to wear' garment that will help to reshape women's bodies. It will promote the design of seamless, fused, smart fabric constructions into the new 21st century underwear and performance support wear.

As the size surveys in the UK and America identified body shapes that do not match intimate apparel manufacturers' block patterns or size charts, it was inevitable the specifications would substantially reduce sales and customer satisfaction.

The technical design specification for new shapewear designs has to consider the following engineering principles.

Pattern Shapes and Grading Methods

By working with a theory devised by a university in the U.S, researchers have identified 7 key body shapes in the UK with six commercial applications.

Bottom Hourglass – Triangle – Hourglass – Spoon – Rectangular – Inverted Triangle.

Approximately 5,500 female scans were used for this research and they calculated key shapes by hip and waist, hip and bust & hip and high hip ratios. A further division by age was considered important that recorded an average set of measurements for each body type.

It is fairly obvious that prototyping cannot be restricted to the traditional model figure type.

To secure a wide population of sales a diverse approach to garment fitting from the body shape data will improve the depth of sales in each key shape. This is particularly applicable to shapewear which has to control a varied menu of sizing requirements. Splitting the figure and garment design into tops and bottoms could offer a sensible route to the diversity of the body shape.

Current grading increments date back to the last UK size survey in 1951, so it is very important to justify our acceptance of their validity and to see whether a new system is required which addresses the body shapes of today.

Stretch Testing

'It is erroneous to assume that a stretch fabric garment will automatically fit in all the right places and provide ease of movement. This is a fundamental misunderstanding of stretch characteristics' (Yu, 2004). Stretch fabrics exhibit a wide range of variation in elongation and recovery properties. 'Watkins (2000) divided contour fit into three categories: form fit, action fit and power fit.' 'Form fit exerts no pressure on the body; action fit holds and supports the body; power fit molds the body into the desired shape.' (Branson and Nam 2007)

Simply compressing the larger figure using powerful stretch warp knits will create bulges of spare body tissue at the hems. Smoothing compression areas into the lines of the body by graduating the tension of the stretch fabric will flatten the figure. To understand the control / compression that a chosen fabric can offer the following simple test should be undertaken.

Cut a 10cm square, parallel to the selvedge edge from the sample fabric and mark the warp and weft grain.

Place the fabric square on a metric set square and extend each grain by securing one edge with the thumb and drawing against that thumb, the leading edge of the square. Three measurements need to be taken, the maximum stretch, the usable stretch and the recovery length after stretching.

The unit of measurement is 1mm = 1% extension or recovery. The arbitory measurement is the usable stretch which must be based on experience of the tester. It would be unlikely to exceed 25mm or 25% for the purpose of shapewear. The recovery length should be within 5%.

A 2cm matrix drawn on the body fabric before cutting and construction can reveal the fitness for purpose of the shapewear design when fitted onto a live model. Uneven distortion of individual squares indicates incorrect pattern shape, lack of any extension indicates flat areas. The garment pattern can then be amended if necessary.

Health Issues

Comfort is one of the most important factors reported by the customer in lingerie surveys conducted by De Montfort University. Comfort issues can affect undue heat, perspiration, hygiene and lymphatic pooling. Although extended compression in either the warp or weft may be desirable for a smooth body shape, it must be controlled. There is no consensus about which pressure level can cause tissue damage, but loading in the range of the blood pressure inside the capillaries could impair the blood flow. The pressure level required to impair or occlude the blood flow is very individual and depends on the individual's general condition and at which tissue area that loading is applied. A tightly fitted shapewear garment could also result in bacteria infections in skin folds, associated with warm, moist and occlusive conditions e.g. under the armpits, and the groin. Anti-fungal properties can be obtained from fabrics containing amounts of active silver fibre, so their use is very suitable. Conventional underwear does not address lymphedema, and can be very uncomfortable for those suffering from the condition. Women complain about the under-wires, thin elastic straps and bands "digging in" at the shoulders, the rib cage, and especially under the breast and armpit.

Marks and Spencer developed a pressure sensor in 2001 to measure pressure fit. This meter can be used to identify pressure points that can develop health issues. Conventional garments tend to be bulky, they lack appropriate adjustability, and they are difficult to get on and off. Well designed shapewear can provide a solution to a number of comfort and health issues.

Seam Technology

Bulky sewn seams are not acceptable in a garment that should offer a sleek moulded shape therefore an investigation into seaming methods is very important. Flatlocked, or overlocked open bulk yarn seams could offer a solution, but heat sealed adhesive silicon film seams are the smoothest joining method.

Silicon film applied between two layers of fabric along the seam and sewn creating a seam with two layers of fabric sandwiched between a layer of adhesive film. Heat, with specific time and pressure elements will activate the adhesive along the seam to assure a smooth seam with superior strength and elasticity.

This formulated urethane film allows for greater design flexibility because it is thinner than the traditional knitted or woven elastics, yet offers the elasticity that fabric tapes lack.

Edge banding film tapes are exclusively designed to replace stitched narrow elastic hems. These 3 layer tapes are applied utilizing a modified sewing machine that folds and applies heat and pressure to a garment's edge. This bonded fold results in a smooth, seamless edge.

The most recent developments to construct seamless shapewear use ultrasonic welding and Bemis film. ‘The seam is joined using the film, opened out and a narrow elastic 10mm wider than seam is welded to the back. The narrow elastic having no horizontal stretch, proves to be 4 times stronger than a conventional sewn seam. Also a Y edge opening has been knitted to waistband elastics to lay in the body of the garment which is again ultrasonically welded using Bemis film.’ (Sew Systems 2008)

Future developments

The February 2001 and 2007 UK Government reports predicted that 50% of women would be clinically obese by 2050. If these future trends prove correct, shapewear will be an increasingly important section of the intimate apparel market for a considerable time. It is necessary to improve the styling of shapewear to promote it as an attractive fashion garment that provides control. Revamping the original control jacquard powernets could add surface interest and reducing their weight would now offer the necessary control. Knitting the jacquard with dyed yarns and adding machine embroidery could improve the impact of the garment.

Improving the fit of the garment by splitting the figure and garment design into tops and bottoms could offer a sensible answer to the six commercial body shapes in the UK.

A further division by age / garment type might be applied to the design functions of the controlwear.

Stretch fabrics exhibit a wide range of variation in elongation and recovery properties. Watkins (2000) divided contour fit into three categories: form fit, action fit and power fit. Simply compressing the larger figure using powerful stretch warp knits will create bulges of spare body tissue at the hems. Smoothing compression areas into the lines of the body by graduating the tension of the stretch fabric will flatten the figure.

Although extended compression in either the warp or weft may be desirable for a smooth body shape, it must be controlled. The pressure level required to impair or occlude the blood flow is very individual and depends on the wearer's general condition and at which tissue area that loading is applied. Marks and Spencer developed a pressure sensor in 2001 to measure pressure fit. This meter can be used to identify pressure points that can develop health issues.

Conventional control garments are difficult to get on and off. Suitably trained retail fitters and marketing literature are essential to solve these customer problems.

Bulky sewn seams are not acceptable in a garment that should offer a sleek molded shape. The most recent developments use ultrasonic welding and Bemis film. 'The seam is joined using the film, opened out and a narrow elastic 10mm wider than seam is welded to the back. The narrow elastic having no horizontal stretch, proves to be 4 times stronger than a conventional sewn seam. Also a Y edge opening has been knitted to waistband elastics to lay in the body of the garment, which is again ultrasonically welded using Bemis film.' (Sew Systems 2008)

It can therefore be seen that the changes in female body shape have already drawn some technical design solutions to the commercial requirements of the growing shapewear market.

References

Adams, A 1853, How to Make a Dress or Help to Those Who Wish to Help Themselves, London (no publishers recorded)

Aldrich, W. 2007, The Emergence of Sizing Systems, History of sizing systems and ready to wear garments, Woodhead Publishing Ltd. Cambridge

Aldrich, W. 2003, The Impact of Fashion on Cutting Practice for the Women's Tailored Jacket 1800 – 1927 In Textile History 3 (2) 134 – 170

Ashdown, S.P. 2007, Sizing in Clothing, Woodhead Publishing Ltd. Cambridge

Camp Fitting Course Handbook 1953 (privately published)

De Alcega, J. 1589, Libro de Geometrica, Practia y Traca, Cafa de Guillermo, Madrid.

Lingerie Buyer. March 1992, Berlei Figure Type Indicator. 134 – 135

Warner Brothers Company. 1951, 2nd Edition, ABCD Bras.

Waugh, N.1954, Corsets and Crinolines, Routledge / Theatre Arts Books, New York

Watkins, P. (2000), 'Analysis of Stretch Garments', in Proceedings of the 80th World Conference of the Textile Institute, Manchester

Yu, W. (2004), 'Objective Evaluation of Clothing Fit', in Clothing Appearance and Fit: Science and Technology, Woodhead Publishing, Cambridge

Newspaper article

Daily Telegraph 7/11/07

Interviews

Turner, T. Sew Systems Ltd. Leicester Jan. 2008