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A Study on the Women's Bodysuit Sleeve Block Construction Using Stretch Fabrics

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Stretch 소재를 사용한 여성용 Bodysuit Sleeve 원형 설계에 관한 연구

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Abstract

The study aimed firstly, to develop the women's bodysuit sleeve block construction method adopting the appropriate pattern reduction rates according to the fabric stretch property. Secondly, the details applied to the bodysuit sleeve block drafting for the educational and industrial usage were proposed. For these, several distinguishing bodysuit sleeve pattern making methods(i.e. Joseph-Armstrong: T1, Shoben & Ward: T2, Esmod: T3 and Mixed Joseph-Armstrong: T4) were analyzed and divided into two categories that adopt ① the equally (i.e., T1) and ② the differently(i.e., T2, T3 & T4) distributed front and back armhole length measurements. Women's sleeve samples were made for the research using the same stretch fabric(50% and 70% in wale and course each) to the previous research. A group comprising 5 relevant experts evaluated the fit and comfort features of the samples. Experiments analyzed the appearance of sleeve samples focused on total 13 evaluation parts(including the front/side/back fit tolerance, sleeve centre line, sleeve length, appropriateness of the sleeve appearance balanced with the bodysuit and etc.); and performed the comfort test evaluating three kinds(vertical-front/ vertical-side/ horizontal) of arm movements. The most appropriate bodysuit sleeve to fulfil the original aims of the study was suggested. The findings and suggestions throughout the study were: 1) the measurements and required reduction rates for the bodysuit sleeve block developed: outer sleeve length (with 1.0 RR), crown height(with 0.7 RR), front and back armhole lengths measured on the bodysuit blocks (0% ease amount), elbow width(0.9/0.95 RR), wrist girth measurements(from 12% to 18% tolerances can be given to); and 2) the differently distributed front and back armhole length measurements resulted in the better fit and comfort through the research.

Key word: Women's bodysuit sleeve, Sleeve block drafting, Stretch wear, Reduction rate, Fit & comfort tests; 여성용 바디수트 슬리브, 슬리브 원형 제도, 스트레치웨어, 패턴 축소율, 외관 및 쾌적성 평가

I. Introduction

The stretch fabric is pervasively used not only for sportswear fulfilling its functional performance but also for outerwear garments allowing a stylish fitted look and comfort flexibility for the various body movements. As can be found in the relevant researches considering the stretch property, issues on the

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sensation of the various fitness wear materials (Lee & Ryu, 1998), pants(Chun et al., 1998), women's shirts blouses(Han & Jo, 2000), straight skirts (Lee et al., 2002), bodysuit(Park, 2003) and cycle wear(Choi, 2004) were debated. In particular, Park(2003) and Choi (2004) implied the reduction rates based on the given fabric stretch property to the patterns developed.

The study was carried out as a sequential research followed after the prior study(Park, 2003) on the women's basic bodysuit block construction(hereinafter, referred to as the "bodysuit blocks" in the paper), which was validated and became the fundamental of the study. The pattern reduction rates suggested in the previous research(Park, 2003) (both the width and length: 0.9, especially, the bust girth: 0.85 for the women's bodysuit blocks using the given 50%: wale and 70%: course stretch fabric) were implied to the required body measurements from the beginning of pattern drafting. The purposes of the study were firstly, to develop the women's bodysuit sleeve block construction method adopting the appropriate pattern reduction rates according to the stretch property given and, secondly, to propose the details applied to the bodysuit sleeve block drafting for the educational and industrial usage throughout a series of the women's bodysuit and sleeve block construction studies.

II. Research Methodology

1. Body Measurements for Women's Bodysuit & Sleeve Block Drafting

To construct the basic women's bodysuit sleeve block for the standard body type, terms in relation with the body measurements referred to in the study were based on the ASTM body measurement table (ASTM Committee D-13 on Textiles and Subcommittee D-13.55), which are used currently by apparel manufacturers and retail organisations. The definitions relating to the body dimensions, in turn, can be implemented to reduce or minimise confusion and dissatisfaction with apparel sizing(ISO Standards: ISO 3635 and ISO 8559; ASTM Standards Terminology D5219). Some terminologies widely used in pattern cutting were also included for more convenient pattern making description. <Table 1> describes the terms used to construct the women's bodysuit and sleeve blocks and the concerned body measurements of a human subject selected for the fit and comfort tests in the research.

Table 1. Terminologies of the body measurements and measured sizes of a human subject to construct women's basic bodysuit and sleeve blocks

Body Measurements		
Girth Measurements(cm)	Vertical Measurements(cm)	Width and Length Measurements(cm)
· Bust (Total): 92	· Waist Length(Front) / Gorge to Waist: 36	· Across-Back Width: 37.78
· Front Bust: 50.8	· Waist Length(Back) / Nape to Waist: 42	· Across-Chest Width: 35.24
· Back Bust: 41.2	· Waist to Bust Point*: 18.5	· Shoulder Length: 12.4
· Waist (Total): 67	· Waist to Underarm Point*: 22.5	· Bust Point to Bust Point: 19
· Front Waist: 35	· Hip Length*: 22.86	· Neck to Bust Point / Side Neck Point to Bust Point: 25.3
· Back Waist: 32	· True Rise / Body Rise: 26	· Mid-Shoulder to Bust Point*: 23.7
· Hip (Total): 95	· Waist to Iliac Crest*: 9	· Gusset*: 19
· High Hip: 90.17	· Outer Sleeve Length**: 58	· Armhole Width**: 11.5
· Front Hip: 45.5		· Armhole Depth***: 16.2
· Back Hip: 49.5		· Total Armhole Length***: 37.8
· Neck Base: 35.5		· Front Armhole Length***: 19.5cm
· Total Crotch: 71		· Back Armhole Length***: 18.3cm
· Elbow Girth**: 25.5		
· Wrist Girth**: 16		

*These terminologies on the body measurements were not defined in particular by the ASTM standards but can be found out in the relevant pattern cutting manuals and used in general by the apparel manufacturers

**Measurements required for sleeve construction

***Measurements required for sleeve construction yet measured indirectly on the given women's bodysuit front & back blocks developed(Park, 2003)

Table 2. Experimental bodysuit sleeves according to pattern making methods

Test No.	Pattern Making Method	Test Description
1	*Joseph-Armstrong* method	T1
2	Shoben and Ward method	T2
3	*ESMOD* method	T3
4	*Mixed Joseph-Armstrong* method adopting the difference between front & back armhole length measurements	T4

2. Fundamental Bodysuit Blocks

As mentioned before, the validated women's front and back bodysuit blocks derived from the previous study(Park, 2003) became a starting point to generate the women's sleeve block in the research. Some measurements(marked with *** in Table 1) were measured on the front and back bodysuit blocks given, i.e. armhole depth and length. The fundamental women's bodysuit block construction process implied certain pattern reduction rates to the required body measurements at a stage of pattern drafting. Those were: 0.9 for both width and length measurements, exceptionally, 0.85, the bust girth in the usage of the selected fabric given with the 50% and 70% stretch property in wale and course direction each (Table 4).

3. Bodysuit Sleeve Block Construction Methods

To construct basic women's bodysuit sleeve block for the standard body type defined by ASTM body measurement, several distinguishing bodysuit or stretch wear sleeve pattern construction methods: Joseph-Armstrong: T1(Joseph-Armstrong, 2000), Shoben & Ward: T2(Shoben and Ward, 1990, based on Shoben & Ward method for woven sleeve therefore adopted 0.9 reduction rate in length measurements except the total sleeve length), Esmod: T3(Esmod Seoul, 2002) and Mixed Joseph-Armstrong: T4(varied Joseph-Armstrong method adopting the difference between front and back armhole length measurements) were selected and designed for the experiment tests(Table 2).

These were divided into two categories implying (1) the equally(i.e., T1) and (2) the differently(i.e., T2, T3 & T4) distributed front and back armhole length measurements to draft the bodysuit sleeve block. Since T1 is the only one kind adopting the equally distributed front and back armhole length measurements among the other methods, T2 and T3, a mixed method, T4 based on the method of T1 and at the same time adopting the difference between front and back armhole lengths, was designed and added to the scope of experiment. Selected sleeve pattern construction methods were compared to each other through block drafting steps that were described in (Table 3). Especially, the increase/reduction rates derived from each pattern construction step could help assume the degree of the samples' fit. The ease amounts of the sleeve armhole length grew bigger in order of T3>T2>T1=T4; the tolerance of the wrist girth was given the same 3cm for T1, T2 and T4 while 2cm for T3.

The sleeve drafting methods, T1 to T4, drove out the experiment sleeve samples constructed in the relation to the standard bodysuit(Park, 2003) with the central back seam line based on the USA 10 size measurements described before. The same stretch fabric was used for making samples as in the prior study(Park, 2003).

4. Fabric Stretch Property

The research used the medium weight nylon-lycra (nylon 80% and spandex 20% mixed) with approximately 70% and 50% stretch in the wale and course directions respectively, that was mostly often selected for the industrial usage(Prex Co., 2003). To comprehend the stretch property in both wale and course directions of the selected fabric, 3 specimens each direction were prepared in the size of 10cm by 10cm with extra 2cm-length spaces on both the top and the

Table 3. Comparisons of the bodysuit sleeve block constructions(based on the given measurements)

Pattern Drafting Process No./ Required measurement	T1: Armstrong	T2: Shoben & Ward	T3: ESMOD	T4: Mixed Armstrong	Note
1 Outer sleeve length	Outer sleeve length=58cm	Outer sleeve length=58cm	Outer sleeve length=58cm	Outer sleeve length=58cm	-
2 The difference between front and back armhole length	Front & back armhole lengths equally distributed	Applied the difference between front and back armhole lengths	Applied the difference between front and back armhole lengths	Applied the difference between front and back armhole lengths	T1 equally & T2 to T4 differently distributed F/B armhole lengths
3 Armhole length	- Front armhole length: Total armhole length/2=(19.5+18.3)/2 =18.9cm - Back armhole length: Total armhole length/2=(19.5+18.3)/ 2=18.9cm	- Front armhole length: 19.5+0.5cm ease=20cm - Back armhole length: 18.3+0.5cm ease=18.8cm (1cm ease total)	- Front armhole length: 19.5+0.7cm ease=20.2cm - Back armhole length: 18.3+1.7cm ease=20cm (2.4cm ease total)	- Front armhole length: 19.5cm - Back armhole length: 18.3cm	T1: 0% increase rate (ease amount: 0cm) T2: 2.7% increase rate (ease total: 1cm) T3: 6.5% increase rate (ease total: 2.4cm) T4: 0% increase rate (ease amount: 0cm) to the original measurement T3>T2>T1=T4
4 Cap height	Outer sleeve length/3.8=15.3cm (Required to calculate the crown height)	Not required	Not required	Outer sleeve length/ 3.8=15.3cm (Required to calculate the crown height)	
5 Crown height	Cap height/2+4.4cm=12.1cm (excluding the 0.5cm seam allowance)=11.6cm	(15cm for woven–1cm)* 0.9 (reduction rate in length)=12.6cm	Armhole depth * 5/6= (16.2cm * 5/6)=13.5cm	Cap height/2+4.4cm= 12.1cm (excluding the 0.5cm seam allowance)=11.6cm	T1: 28.5% RR T2: 22.2% RR T3: 16.6% RR T4: 28.5% RR(to the armhole depth 16.2cm) * RR: reduction rate T3> T2> T1= T4
6 Elbow length (from the bicep line to the elbow line)	(Outer sleeve length-crown height)/2=(58–11.6)/2=23.2cm	(Outer sleeve length-crown height)/2–0.9cm=(58–12.6) /2–0.9cm=21.8cm	(Outer sleeve length-crown height)/2–2cm=(58–13.5)/2– 2cm=20.25cm	(Outer sleeve length-crown height)/2=(58–11.6)/2=23.2 cm	T1=T4>T2>T3
7 Bicep width	Front: 14.3cm Back: 14.3cm Total: 28.6cm (Front & back equally distributed)	Front: 15.6cm Back: 13.3cm Total: 28.9cm (Front & back differed)	Front: 13.15cm Back: 13.15cm Total: 26.3cm (Front & back equally distributed)	Front: 15.5cm Back: 13.25cm Total: 28.79cm (Front & back differed)	T2>T4 >T1>T3
8 Elbow width	Front: 11.35cm Back: 11.35cm Total: 22.7cm (Front & back equally distributed)	Front: 13.05cm Back: 11.1cm Total: 24.15cm (Front & back differed)	Front: 12.25cm Back: 12.25cm Total: 24.5cm (Front & back equally distributed)	Front: 12.9cm Back: 11.0cm Total: 23.9cm (Front & back differed)	T1: 11% RR/T2: 5.7% RR T3: 3.9% RR/T4: 6.3% RR to the original measurement 25.5cm T3>T2>T4>T1
9 Wrist width	Front: 9.5cm Back: 9.5cm Total: 19cm (Front & back equally distributed)	Front: 10.26cm Back: 8.74cm Total: 19cm (Front & back differed)	Front: 9cm Back: 9cm Total: 18cm (Front & back equally distributed)	Front: 10.26cm Back: 8.74cm Total: 19cm (Front & back differed)	T1: 18.8% (3cm tolerance) T2: 18.8% (3cm tolerance) T3: 12.5% (2cm tolerance) T4: 18.8% (3cm tolerance) to the original measurement 16cm T1=T2=T4>T3

Table 4. Details of the stretch fabric used for the bodysuit construction

Fabric Composition	Width(Inch)	Weight(G/M^2)	Stretch Property(%)
Nylon 80% Spandex 20%	60	194	48.0(Wale) 67.7(Course)

Table 5. Statistics of the fabric stretch property test

Sample Direction	Test1	Test2	Test3	Mean	Standard Deviation
Wale	46.0(%)	50.0(%)	48.0(%)	48.0(%)	2.00(%)
Course	67.0(%)	68.0(%)	68.0(%)	67.7(%)	0.58(%)

bottom edges for the tester clip gripping to make up the 14cm length in total and 10cm width specimens. The samples were left in the room condition(20±2°C temperature, and 65±2% relative humidity), in turn, stretched 4 times with an 1000g weight for 5seconds each and then the fifth extension was recorded after 10seconds(KITECH, 2003). <Table 4> and <Table 5> describe the details and the resultant stretch figures of the fabric given.

5. Experimental

1) Fit Test

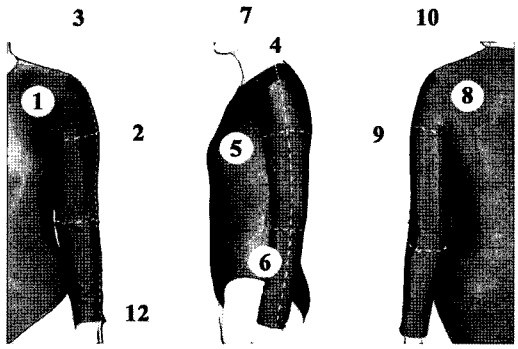
Five professional pattern making staff evaluated the fit and appearance of the test samples, T1 to T4 constructed for the research by means of the 5-scale evaluation i.e. from degree 1, very bad to degree 5, very good(Table 6). <Fig. 1> depicts the 13 whole fit evaluation points consisting of mainly 4 parts, i.e. front(EP1. Front Armhole, EP2. Front Upper Arm, EP3. Front Appearance), side(EP4. Shoulder Line, EP5. Side Upper Arm, EP6. Sleeve Center Line, EP7. Side Appearance), back(EP8. Back Armhole, EP9. Back Upper Arm, EP10. Back Appearance) and total(EP11. Total Fit, EP12. Bicep to Wrist Length, EP13. Balance with the Bodysuit) parts of the sleeve.

2) Clothing Comfort Test

With regard to clothing comfort of the designed bodysuit sleeves, the research performed the comfort test by estimating 3 arm movements in vertical and horizontal ways i.e. front-vertical, side-vertical and horizontal(Lee, 2002) movements as shown in (Fig. 2). The estimation was carried out 3 times per sample worn by a human subject given for the research.

Table 6. 5-scale grade for the fit and appearance

Grade	Fit & Appearance Evaluation
1	very bad
2	bad
3	moderate
4	good
5	very good



11 : Total Fit & Tolerance

12 : Total Sleeve Length

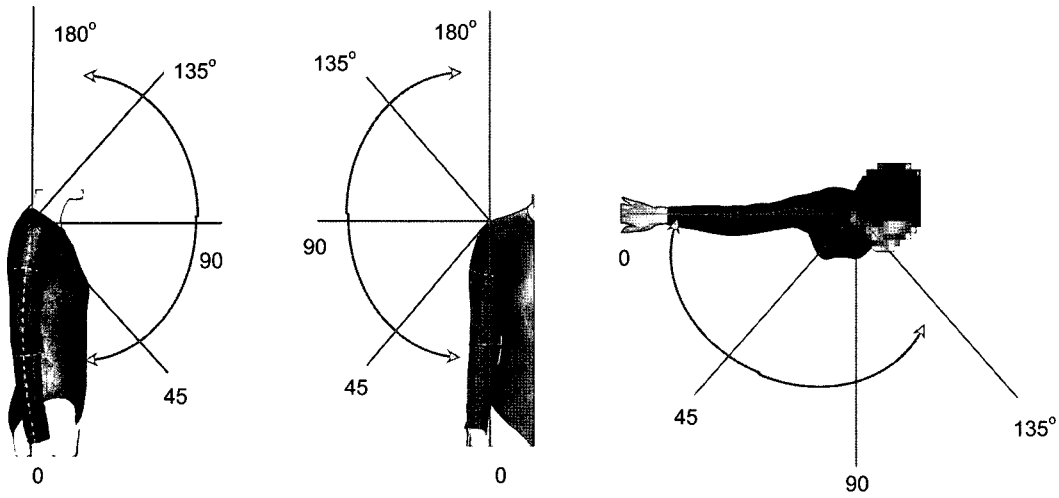
13 : Total Sleeve Appearance Balanced with the Bodysuit

Fig. 1. 13 evaluation points of the bodysuit sleeve for the appearance fit test

II. Results and Discussion

1. Comparison of the Bodysuit Sleeve Block Construction Methods

The comparison of the bodysuit sleeve block draft methods mentioned before highlighted certain points



EM1: Front-Vertical **EM2: Side-Vertical** **EM3: Horizontal**

Fig. 2. 3 evaluation arm movements of the bodysuit sleeve for the comfort test

related with the difference between front and back armhole length measurements, ease amounts added and reduction rates given.

The outer sleeve length measurements for the samples, T1 to T4, were set as the same as 58cm with no pattern reduction rate given while other length measurements adopted the reduction rates(RR) varied according to their drafting methods. For instance, the crown heights of the samples vary from 11.6cm to 13.5cm, i.e. 28.5% crown height reduction rate in T1, 22.2% RR in T2, 16.6% RR in T3 and 28.5% in T4 compared to the original armhole depth, 16.2cm, measured on the bodysuit blocks provided. These show the order of T3(13.5cm)>T2(12.6cm)>T1=T4 (11.6cm). As can be seen in table 3, the elbow length measurements of the samples are in order of T1= T4(23.2cm)>T2(21.8cm)>T3(20.25cm). Since the samples are to develop the basic sleeve block from which various vertical styles can be varied, the total sleeve length remained as the original measurement.

To consider the difference between front and back armhole lengths, the experiment classifies the constructed samples into mainly two, i.e. (1) the equally and (2) the differently distributed front and back armhole lengths. T1 is in the first category while the others are in the second one. In addition to this, the selected sleeve construction methods also present the differed ease amounts implied to the samples that are T3(2.4cm)>T2(1cm)>T1=T4(0cm ease).

The construction of the bodysuit sleeve upper arm requires the armhole lengths(total or front and back armhole lengths) and the crown height. Concerning these two measurements, ESMOD method, T3, has the longest crown height and the maximum ease amount, 2.4cm and adopts the front and back armhole lengths difference.

The factor to adopt the front and back measurements difference, the ease amount and crown height to the sleeve block construction was analysed to be able to impact on the bodysuit sleeve fit and comfort.

The comparisons on the bicep, elbow and wrist width measurements of the samples are: T2>T4> T1>T3(T1 & T3: equally and T2 & T4: differently distributed front and back measurements); T3>T2> T4>T1(T1 & T3: equally and T2 & T4: differently distributed front and back measurements) and T1 =T2=T4>T3(T1 & T3: equally and T2 & T4: differently distributed front and back measurements) respectively.

2. Fit Test Results

In the aspects of front, side, back and total views, the fit test evaluated the appearances of the sample

bodysuit sleeves and <Table 7> shows the statistics of the test and the comparisons of each evaluation.

Throughout the analysis of the front, side and back upper arm appearances of the sleeves, T1 gains the lowest score even lower than T4 which contains the same ease amount compared to T1. The investigation supports this may be related firstly with the zero ease amount given to the armhole length which causes the strained wrinkles around the bodysuit's armhole and secondly with the equally distributed front and back armhole length measurements affecting the back upper arm appearance.

Seeing the side appearance evaluations of the shoulder point position, i.e. T2/T4>T3>T1 and of the sleeve center line, i.e. T2>T3>T4>T1, the implementation of the differently distributed front and back armhole lengths to the stretch sleeve construction was regarded to bring about better fit results.

The significance comparisons of the total sleeve fit tolerance and appearance balanced with the bodysuit were: T3=T4>T2>T1 and T3>T4>T1>T2 each. In conclusion, the mean value of the whole evaluation scores of each test sample was compared to each other and <Fig. 3> then depicted the result in order of T3>T4>T2>T1. It seems to be highly feasible that the zero ease amount adopted to the armhole length

Table 7. Comparison of the fit test statistics for the experimental samples

Body Part	Evaluation Part No.	Description							
		Fit Test: Mean (S.D.)				t-Distribution P-Value Analysis			Significance Comparison
		T1	T2	T3	T4	$p<.05$	$p<.1$	$p<.2$	
Front	EP1. Front Armhole	4.2(0.45)	3.4(0.89)	4.0(0.71)	4.0(1.00)			T1&T2	T1>T2
	EP2. Front Upper Arm	2.8(0.84)	3.6(0.89)	4.0(0.71)	3.6(0.89)	T1&T3		T1&T2 T1&T4	T3>T4>T2>T1
	EP3. Front Appearance	3.2(0.84)	3.0(0.71)	3.4(0.89)	3.2(0.45)	T1&T3			T3>T2
Side	EP4. Shoulder Point	3.0(0.71)	4.2(0.45)	3.4(0.55)	4.0(0.71)	T1&T2 T2&T3	T1&T4	T3&T4	T2/T4>T3>T1
	EP5. Sleeve Center Line	2.6(0.89)	3.8(0.45)	3.8(0.45)	4.0(0.71)	T1&T2 T1&T3 T1&T4			T2=T3/T4>T1
	EP6. Side Upper Arm	2.4(0.55)	4.4(0.55)	3.4(0.89)	3.6(0.89)	T1&T2 T1&T4	T1&T3 T2&T3	T2&T4	T2>T3/T4>T1
	EP7. Side Appearance	2.6(0.55)	3.0(1.0)	3.6(0.55)	3.2(0.45)	T1&T3	T1&T4		T3>T4/T2>T1
Back	EP8. Back Armhole	2.0(0.71)	3.8(0.84)	3.8(0.84)	4.2(0.84)	T1&T2 T1&T3 T1&T4			T4>T2=T3>T1
	EP9. Back Upper Arm	1.8(0.45)	3.8(0.45)	3.8(0.45)	4.0(0.71)	T1&T2 T1&T3 T1&T4			T4/T2=T3>T1
	EP10. Back Appearance	3.8(0.84)	2.8(0.84)	3.8(0.84)	3.2(0.45)		T1&T2 T2&T3	T1&T4 T3&T4	T1=T3>T4>T2
Total	EP11. Total Fit	3.4(0.55)	3.6(0.89)	4.0(0.71)	4.0(0.71)			T1&T3 T1&T4	T3=T4>T2>T1
	EP12. Total Sleeve Length	4.0(0.71)	3.4(0.89)	4.4(0.55)	3.6(0.55)	T3&T4	T2&T3		T3>T1/T2/T4
	EP13. Balance with Bodysuit	3.5(0.50)	2.8(0.84)	4.0(0.71)	3.8(0.84)	T2&T3	T2&T4	T1&T2	T3>T4>T1>T2
Mean of Total Sum Score		3.02	3.51	3.80	3.72	T3>T4>T2>T1			
S.D. of Total Sum Score		0.75	0.51	0.29	0.35				
95% Upper Confidence Limit		3.45	3.79	3.97	3.92				
95% Lower Confidence Limit		2.60	3.22	3.63	3.52				

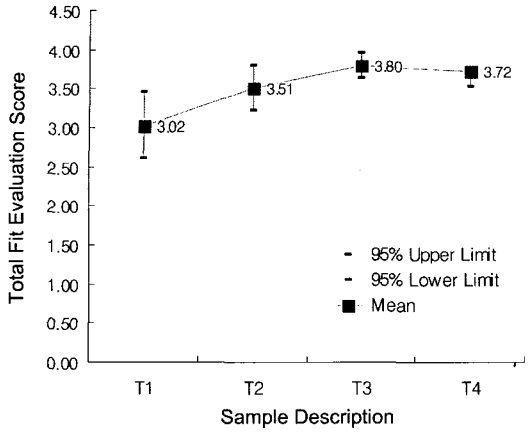


Fig. 3. Comparison of the experiment bodysuit sleeve total fit test score means

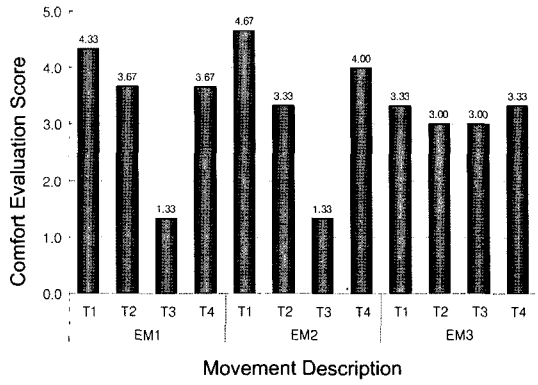


Fig. 4. Comparison of the experiment bodysuit sleeve comfort test scores

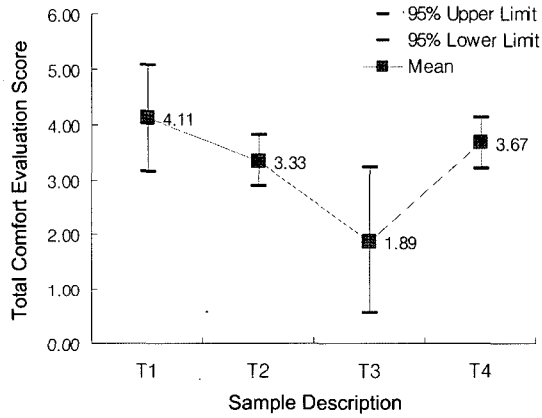


Fig. 5. Comparison of the experiment bodysuit sleeve total comfort test score means

and the equally distributed front and back armhole lengths applied to the sleeve pattern construction can affect the whole sleeve appearance.

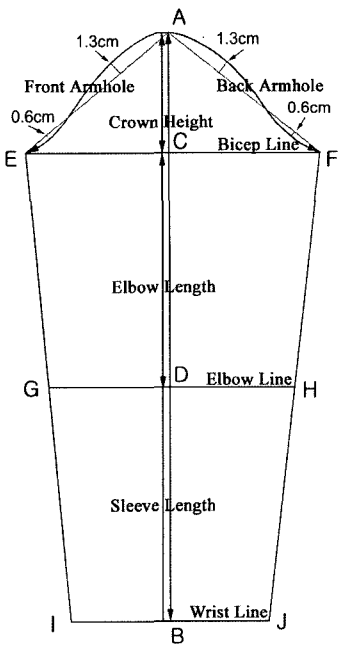
3. Comfort Test Results

In addition to the analysis of the sleeve samples fit, the research enhanced the experiment by carrying out the bodysuit sleeve comfort test. 3 front and side vertical and horizontal arm movements were evaluated in the sense of sleeve comfort. Observing <Fig. 4>, the comparison of four test samples' horizontal movement evaluations does not make a difference of significance as the resultant scores were found in the close range of 3.0 to 3.3. However, in the cases of the other two vertical movement evaluations, T3 gains the lowest evaluation scores i.e. both 1.33 of 5.0 while others are all above 3.0. To see the evaluation of EM1, the comparison of the test sleeve samples resulted in order of T1(4.33)>T4(3.67)>T2(3.67)>T3 (1.33) and similar assessment of T1(4.67)>T4(4.00) >T2(3.33)>T3(1.33) seen in the evaluation of EM2. The comparison of the total comfort test score means for T1 to T4 is shown in <Fig. 5>, which is: T1(4.11) >T4(3.67)>T2(3.33)>T3(1.89). The crown height reduction rate and the given ease amount to the armhole length are considered as the main causes influencing the sleeve comfort evaluations.

According to these, although the tight upper arm may gain lower fit scores, the higher reduction rate to the crown height measurement to construct the upper arm(e.g. 0.7 RR in T1 and T4) could give a better comfort evaluation in vertical movements. Thereafter, it became an issue of importance to balance the fit and comfort of the stretch sleeve construction in the research.

4. Suggested Bodysuit Sleeve Block Construction Method

The results derived from both the fit and comfort tests are considerably differed. To take obvious examples from them, the first one, T3 adopted the most armhole ease amount(e.g. 2.4cm), the longest



A-B = Outer sleeve length

A-C = Cap-height/2 + 4.4cm

B-D = One half of B-C. Square lines out from C, D and B.

A-E = Front armhole measurement. Divide into thirds and draw sleeve cap as illustrated.

A-F = Back armhole measurement. Divide into thirds and draw sleeve cap as illustrated.

B- I = Front wrist measurement.

B-J = Back wrist measurement.

Draw lines from I to E and J to F

Fig. 6. Bodysuit sleeve block construction procedure suggested

crown height(including 0.85RR) compared to other samples and the differently distributed front and back armhole lengths, which gained a better estimation in the fit test but the least one in the comfort test. Secondly, test samples, T1 and T4, were based on the same draft method of Joseph-Armstrong, however, their difference was caused by the adoption of the equally(T1) and differently(T4) distributed front and back width measurements. T1 and T4 had the features of the least armhole ease amount, e.g. 0cm, and the shortest crown height including 0.7RR among the samples, that gained a lower evaluation in the fit test for the tight appearance in the upper arm area but a higher one in comfort test. According to the subjective comfort evaluation, the less ease amount of the armhole length and the higher reduction rate for the crown height could provide the supported feeling by tightening the body, which means better comfort. With balancing the fit and comfort test analyses, T4 was finally suggested as the most appropriate stretch sleeve block based on the previously developed bodysuit block, of which drafting procedure details are explained in (Fig. 6).

IV. Conclusion

To fulfil the original goals of the study to define the women's bodysuit sleeve block construction method with the relevant reduction rates or the ease amount in the usage of the four-way stretch fabric having approximately 50% and 70% extensibility in wale and course respectively; and consequently to propose the details of the validated bodysuit sleeve block drafting procedure, several bodysuit sleeve pattern making methods widely used in the relevant industry and education were analysed.

In the bodysuit sleeve block construction, the difference between front and back width measurements, the ease amount given to the armhole length and the crown height as well as the reduction rates mainly based on the previously developed bodysuit blocks were considered to be able to impact on the completed bodysuit sleeve's fit and comfort both. Considering these features, 1.0 reduction rate(RR) for the outer sleeve length as it is for the basic block from which various styled patterns can be developed; a zero armhole ease amount; approximately 0.7 RR for the crown height; and differently distributed armhole

and wrist measurements were suggested for the women's bodysuit sleeve block drafting. The fit and comfort test experiments validated this new sleeve block construction method. The findings and suggestions throughout the research were as follows:

(1) The measurements and required reduction rates for the bodysuit sleeve block developed in the study: outer sleeve length(1.0 RR), crown height(0.7 RR), front and back armhole lengths measured on the bodysuit blocks(0% ease amount), elbow width(0.9/0.95 RR), wrist girth measurements(from 12% to 18% tolerances can be given to). The pattern reduction rates went around the figure with the given stretch fabric to allow the appropriate minus tolerances to the women's bodysuit sleeve block. The reduction rates were applied from the beginning of the block construction procedures as carried out in the earlier research(Park, 2003).

(2) Individually measured front and back armhole lengths, elbow girth and wrist girth showing the differently distributed front and back proportions were respectively implemented to construct the front and back sleeve block which resulted in a better fit.

The women's bodysuit and sleeve blocks developed through the previous and current studies enable to construct the relevant stretch or active wear. The women's bodysuit and sleeve blocks and the results from the conducted tests can be also referred to for the sequential studies on the clothing reduction rates based on the stretch material properties.

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요 약

신축성 소재 여성용 바디수트 원형 설계에 관한 선행연구에서 개발된 바디수트의 진동둘레길이 항목을 적용한 소매원형 제도방법이 제안되었다. 본 연구는 선행연구와 연속적 맥락에서, 첫째, 신축성 소재의 물성을 고려한 패턴축소율의 적용을 제시하고 둘째, 그에 따라 개발된 여성용 바디수트 소매원형의 제도방법의 단계별 서술을 통해 교육 및 산업분야에서의 사용을 목적으로 하였다. 본 연구를 위하여 광범위하게 사용되고 있는 기존의 소매원형 제도방법을 우선, 선정하여(i.e. Joseph-Armstrong: T1, Shoben & Ward: T2, Esmod: T3 그리고 Joseph-Armstrong 절충식: T4) 분석하였다. 그 가운데 소매의 앞뒤차가 반영되지 않는(i.e. T1) 것과 반영되는(i.e. T2, T3 그리고 T4) 방법으로 나누어 구분하고 그에 따른 바디수트 소매샘플을 선행연구와 동일한 신축성 소재(wale: 50%/course: 70%)를 사용하여 제작한 후, 5인의 전문평가단을 구성하여 그 외관과 동작적합성을 평가하였다. 외관평가에서 관찰된 항목은 앞, 옆, 뒤 바디수트 소매의 여유분, 중심선의 위치와 소매길이, 그리고 바디수트 몸판과의 조화정도의 총 13항목이었고, 쾌적성 평가에서는 전방수직, 측방수직, 측방수평 3동작을 통해 실험의의 동작적합성을 평가하였으며 최종적으로 외관과 동작성이 적절히 조화된 바디수트 소매원형을 제안하는 과정을 거쳤다. 외관평가에서 T3>T4>T2>T1 순서로 우수하게 평가되었으며, 동작적합성 평가에서는 T1>T4>T2>T3의 순으로 평가되어, 외관적으로는 여유분이 적어 당겨 보이는 이유로 점수가 낮아도 쾌적성에서는 오히려 죄어주는 것이 안정감이 있다고 분석되었다. 따라서 외관과 쾌적감의 균형을 고려하였을 때 최종적으로 T4, 즉, 소재의 신축성에 따른 패턴축소율(전체소매길이: 1.0RR, 소매산높이: 0.7RR, 팔꿈치둘레: 0.9RR)이 반영되고, 진동둘레에 제로 이즈량을 부가하였으며, 앞뒤차가 반영된 바디수트 소매 원형 제도방법이 제안되었다.