Chapter

Review on Analysis of Seam Quality

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Abstract

The apparel quality largely depends on fabric quality and also on seam quality. Seam performance and appearance largely correlate with fabric characteristics, sewing-thread properties, selection of stitches and seams, and also with sewing conditions such as size of needle, sewing-thread tension, number of stitches per inch, and maintenance and operation of sewing machine. In good quality garments, functional requirements of the seam are very essential for apparel serviceability. The seam performance deteriorates the quality of garment by reducing seam strength and seam-slippage strength, seam puckering, and seam damage. Apparel durability and its esthetic performance are defined by seam quality. Seam performance is influenced by a selection of seam type with respect to stitch classes, selection of sewing threads irrespective to fabric characteristics, and different sewing process parameters.

Keywords: apparel quality, apparel serviceability, seam appearance, seam performance, seam quality

1. Introduction

The basic constituent of quality apparel is stitches and seams. The different components of apparel joint together by means of stitching operation and seams are responsible for giving the apparel shape for wear [1, 2]. The overall performance of the apparel in use mainly depends on the quality of seam [3]. Seam is the joining of two or more pieces of fabrics by means of stitching. The quality of seam greatly influences on the quality of apparel. The quality of seam is assessed by means of its efficiency, elongation, bending, stiffness, abrasion resistance, seam-slippage strength, puckering, tightness, boldness, and seam damage [4]. A good seam has functional and aesthetic requirements. The functional performance of the seam is evaluated by efficiency, elongation, density, slippage, bending stiffness, and abrasion resistance of seam [5]. Whereas seam puckering, tightness, boldness, and seam damage are assessed for better elegant performance of the seam [6]. The basic raw material of garmenting is fabric and sewing thread. The apparel seam quality depends on raw material characteristics [7]. Seam performance by means of durability is based on the strength and efficiency of seam as well as seam appearance along the seam line attributed by the seam pucker [8]. These seam parameters are very important for garment manufacturers and customers, as it affects the customers' opinion regarding quality of garment [9]. Some of the manufacturers

select stitch classes, stitch density, and sewing threads without consideration to their influence on the overall performance of the apparel being made, resulting in failure of the seam during use [10]. It is therefore very important to select appropriate seam for better performance of apparel. Seam types are one of the factors influencing the overall performance of the seam in terms of durability, comfort, and potential for alteration. The appearance of a seam is generally lead by the proper relationship between the size and type of thread, the stitch density and its types, and the texture and weight of the fabric [11]. Many researchers found that fabric quality parameters, such as fabric density, fabric thickness, tensile strength, extensibility, bending rigidity, and shear rigidity have extreme effect on quality of seam [12]. Different researcher gives a subjective ranking for evaluation of seam performance [13]. Experts revealed that seam is evaluated by its analytical dimensions, such as strength, puckering property, efficiency, slippage strength, and seam boldness. High-speed sewing machine exerts high tensions and needle penetrates in high forces through the fabric. In this stage, damaging of sewing threads and warp and weft in the fabric result in poor seam performance by means of reducing seam strength and seam slippage [14, 15].

2. Influence of sewing thread on seam quality

Sewing thread is a crucial factor that not only has effect on durability of garment but also on overall design [16]. Tensile properties of sewing thread influence on the productivity of apparel manufacturing [17]. Sewing thread should have sufficient tensile strength, should be uniformly twisted throughout the length, smooth and elastic, and plied yarn treated by special finishes to increase its abrasion resistance during stitching operation [18]. It can be spun from staple yarn, filament, or core spun yarns. The thread must be withstand the several wash and hold the seams together for the life of the garment. Cotton and polyester sewing thread are most commonly utilized by the clothing industry [19, 20]. Sewing thread plays a very crucial role for improving the quality of garment. Poor quality of sewing thread increases the production cost rapidly since they cause frequent stoppages of sewing machines. Types of sewing thread used for stitching depend upon the fabrics being used. Polyester sewing thread is more durable than the cotton sewing thread [14, 21]. Higher strength of thread is prone for giving higher seam strength shows better functional performance of seam [22]. The other parameters of sewing thread also decide the seam performance, such as type of sewing thread, number of ply, type of finish, twist, and size of thread. For all types of apparel spun polyester thread, three-ply thread with optimum twist and standard finish sewing thread quality is widely used [23]. Seam efficiency of polyester textured thread lies in between cotton and spun polyester threads, but more closer to apparel stitched with spun polyester threads [21]. A few research works emphasis on influence of thread finishes on performance of seam. It revealed that as per the specific end use of apparel, different types of finishes are used on thread [22]. The size of sewing thread and number of ply decide the seam stability in apparel. The seam strength and seam puckering also depend on the thread size and ply [24]. During stitching, greater friction occurs with higher sewing-thread size, which ultimately results into less seam strength and increased seam puckering. While more number of ply assists for increasing the thread strength resulting higher seam strength and seam efficiency with less seam slippage. But the diameter of thread increases with number of ply leading to structural jamming along the seam line, which results into more seam puckering [16, 25]. The draping characteristics of apparel are also affected due to the increasing stiffness by means of number of ply in sewing thread [20]. Type of

sewing thread and fabric weave influences on seam elongation in both directions. Plain cotton fabrics show higher seam elongation in warp direction, whereas twill weave of cotton fabrics shows higher seam elongation in weft direction. This is attributed due to the fact that during stitching, stitching threads may be subjected to stretching and bending, results into shrinkage in relaxation process after sewing operation [26]. One of the performance property of seam is seams abrasion resistance, which is determined by sewing thread. The abrasion resistance of core-spun threads is better than other fiber threads [19, 27].

3. Influence of fabric parameters on seam quality

Apparel manufacturers considered the specification of fabrics in terms of basic and supplementary characteristics for apparel quality. The basic qualities are related to the mechanical dimensions of fabric, and supplementary qualities are related to the fabric performance on an applied dynamic force [28]. The clothing manufacturers are mainly focused on the supplementary qualities of the material and emphasis on seam quality during fabrication. On contrary to this, consumer are mainly focused on comfort, look, and wear ability of fabric and assess seam quality on the basis of seam appearance [4, 10]. The good quality fabrics gives comforts as well as evenly working of apparel processes and leads to fault-free garments [15, 29]. Apparel seam performance depends on the fabric cover factor, fabric weight, thickness, tensile strength, fabric shrinkage along the fabric length and width, resiliency, bending rigidity, flexural rigidity, and shear rigidity [8]. Fabric selected for making the garment should possess good sewability [1]. A good sewable fabric has the propensity and the ease with which two-dimensional fabric components can be qualitatively and quantitatively be seamed together to three-dimensional garment [22]. The ease of formation of shell structures on the fabric surface indicates that the fabric possesses good sewability producing pucker-free garment. A resulting sewability is due to the integration of various variables interconnected with stitching thread, material, and stitching machine settings at their optimum level [27]. Many researchers have been studied on fabric sewability of various types of fabrics. Research studies revealed that both stitch length and stitch density together with knitted fabric relaxation methods has found significant influence on seam elongation. But, it shows negative impact on seam strength and seam efficiency. Increasing stitch length and yarn twist factor, decreases seam strength and efficiency. But, stitch density is directly proportional to the seam strength and seam efficiency. If stitch length increases, decreases the strength of knitted fabric which attributed to decreasing the seam strength. But, increasing stitch length will increases fabric elongation, which shows higher seam elongation. More twist factor leads to an increase in yarn elongation, which attributed to increase of the knitted fabrics elongation. Therefore, as the yarn twist factor increases, causes the increase in seam elongation [1, 8]. The study on sewing performance of stretch denim revealed that with the increase in Lycra percentage in denim seam efficiency increases. This is due to the higher flexibility and better compatibility of the sewing thread with denim. More Lycra percentage in denim increases the flexibility thereby improving the seam performance [16]. Many researchers studied on the effect of fiber type and its percentage on the seam performance. The fiber percentage significantly influences on the seam stiffness. The study revealed that the change in blending of polyester and cotton, the seam stiffness increases due to decreasing polyester fiber content in fabric which has low bending stiffness. On the other hand if polyester percentage is more in fabric show less resistance during sewing operation. However, the linear density of sewing thread shows insignificant

effect on seam stiffness [12, 24]. Different blended fabrics show significant effect on drape coefficient. Polyester dominating fabric shows low drape coefficient due to higher low-stress extensibility. On the other, hand cotton dominating fabric shows high drape coefficient, since cotton has the more bending stiffness than polyester [28].

4. Seam strength

Poor seam performance makes the garment inappropriate even though the material strength is high. Therefore, it is very crucial to divine the seam strength in terms of the performance of apparels during use [7]. It is defined as a load required for breaking seam and it results from the breakage of either textile material or sewing thread or sometimes both simultaneously [29]. Different types of garments have different seam strength requirements. Many factors affect the level of seam strength [30]. Seam strength depends on the fabric quality, thread strength, and stitch density along with the stitch and seam selection and sewing conditions. But, it has been found that the fabric strength is not expected to cause any adverse effect on seam strength. Seam strength correlates with thread types, different classes of seam and stitch [16]. Many previous studies reported that seam strength depends on the thread strength and stitch density. Stitch length is indirectly proportional to the seam strength. It is due to the fact that, as the stitch length increases, the number of loops that shares the load decreases, resulting in decreasing seam strength [9, 19, 21]. The fabric speed during stitching operation also decreases with lower stitch lengths, which leads to a uniform distribution of stitches [27]. The seam strength is also higher with polyester core spun sewing thread is used as the bobbin thread rather than polyester-cotton core spun sewing thread [9]. Seam strength of higher density fabric is found better than that of lower density. This is attributed due to the higher tensile strength of fabric and more stripping of the needle thread through the fabric [19]. Sewing-thread parameters such as type of thread, its size, and its constructional features and finishing influence on seam strength. The linear density of sewing thread is expected to affect the seam strength, the thicker thread gives a better seam strength, and nevertheless it requires the use of a thicker needle which may damage the fabric [8]. Seam strength is also the product of the sewing thread loop strength at a standard gauge length and the number of loops in a given width of seam which depends on stitch length. It is therefore reveled that loss in the strength of the needle and bobbin threads significantly affects the seam strength of the fabric. The loss of needle thread strength is higher during sewing operation than bobbin threads strength [21]. The fabric types show significant influence on the needle thread strength loss [22].

5. Seam strength efficiency

Seam efficiency plays a very crucial role for obtaining desirable seam performance with the help of the ratio of sewn fabric strength to unsewn fabric strength [31]. The tensile behavior of fabrics and sewing thread, the sewing-thread properties, the combination of fabric and thread, and machine and process parameters together decide the seam efficiency. Seam efficiency of 85 and 90% is difficult to achieve. The apparel manufacturer expected seam efficiency in the range of 60–85% [28, 31]. Many researchers were studied on the effect of different fabric blend percentage and thread tension on seam efficiency. Higher fabric strength

gives less seam strength efficiency for a given sewing thread. Seam efficiency is also depends on the blend composition in fabric. Polyester dominating fabric shows low seam strength efficiency. This is due to the fact that polyester gives higher flexibility in the low load region, hence, reducing fabric dimensional stability. The decreasing seam efficiency is due to the less uniform fiber matrix causing fiber slippage and yarn failure. Higher linear density sewing thread has better gripping with the textured polyester in polyester dominating fabric resulting high seam strength efficiency. But, seam strength efficiency increases with cotton dominating fabric due to the uniform fiber matrix [1, 29]. The seam strength efficiency also depends on the needle-thread tension. During stitching operation, all low-thread tension considerably improves the seam efficiency. This is attributed to the fact that some flexibility at the seam occurs at low needle thread tension under sudden stress. In contrast at high tension, the fabric has been pulled along the seam line leading to puckered and unstable seam [17]. The linear density of sewing thread also shows considerably effect on seam efficiency. Seam efficiency increases with increasing the linear density of sewing thread due to the more number of fibers is incorporated in the coarser sewing thread [14, 19]. Researchers concluded that core-spun polyester thread show higher seam efficiency. Stitch density is directly proportional to the strength and efficiency of seam [8].

6. Seam puckering

It is the increments in the seam thickness over the fabric under a constant compressive load, which appears along the seam line. This particular effect appears when the sewing variables and fabric properties are not correlated [24]. It has been revealed from many studies that seam puckering depends on the sewn fabric [6]. Seam puckering is assessed in terms of seam thickness strain percentage and it is measured by the thickness difference in fabric and seam [18]. Seam pucker is an unacceptable seam appearance found due to seam gathered either just after stitching or after finishing and the contractive forces introduced in seam during stitching operation. Seam puckering increases with increasing fabric weight irrespective of type of sewing thread [24]. Many research studies reported that seam puckering is highly contingent on linear density of sewing thread [16]. The coarser thread leads to fabric structural jamming and less flexibility at the seam causing more seam puckering. Also, polyester fabrics show high seam pucker than cotton fabrics. This is due to the fact that polyester dominating fabric gives higher extensibility in the low load region, hence, reducing fabric dimensional stability resulting into high seam puckering [18]. In spite of this, fabric weave and weft setting show significantly effect on seam pucker [31].

7. Seam slippage

Seam slippage is identified by the load need to discrete the seam by a certain distance. Seam slippage is less if higher load is required to separate the seam and indicates the textile is more resistant to seam slippage. The fabric stitched with core spun sewing thread showed higher slippage strength. This can be attributed to high extensibility of core spun sewing thread. With polyester filament, the seam slippage is lower because of less flexibility and compact structure of polyester thread. Seam slippage is also increased with silicone finish, since silicone is participating in mobilizing the threads and at less force the desired seam opening is possible [16, 28].

8. Seam damage

In garments, a constant occurring phenomenon is a seam damage. It is also termed as a sewing damage. Most of the complaints arise from customers are due to the seam damage [17]. Seam damage is evaluated by the needle cutting index. It not only depends on the fabric weave and cover factor but also on the thread diameter, surface properties of thread and stitch density [32]. The results from many studies found that with increasing Lycra percentage in denim and fabric weight rises needle cutting index. It is attributed due to the voluminous structure of Lycra yarn inside the fabric structure mainly at interlacing points and leads to higher frictional force between yarn and needle [3, 32, 33].

9. Conclusion

In this chapter, seam quality parameters have been discussed. During the production of the apparel, manufacturers only deals with fabric characteristics and more prominence about seam quality. On the other hand, consumers are assessing seam quality on the basis of seam appearance, comfort, and wear ability. Seam performance largely depends on the interrelationship between fabric structural properties, sewing threads, sewing process conditions, and the number of washes the garment will receive. Different stitching threads will show different results on seam standard and seam performance. Types of fabric and their structural properties have significant effect on seam strength, seam efficiency, seam elongation, and seam puckering. The seam quality expectations for various apparels will be different. It can be therefore concluded that, it will be advantageous to investigate the sewing performance of any type of fabrics fit for various applications.

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