

Seams - A Comparative Study of Hand Stitch And Machine Stitch

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Abstract:

Background

Indian Apparel industry is one of the largest and fastest growing industries in the world. It is one of the largest contributors to net foreign exchange earnings of the nation through export. Quality and Serviceability are the two components which can be defined by the workmanship, material, acceptable design, and comfort in the apparel. Serviceability depends on the structural construction of the garment of which seams play an important role. In India hand stitches has been used in traditional garments which have survived over a period of time. Also from review, it was found that hand stitches are stronger than machine at some places in apparel.

Method

Back stitch and chain stitch are two important hand stitches which are stronger than machine stitch. This research was carried out to compare the machine stitch with hand stitch for its strength and increasing durability at specific parts in the garment. Cotton and silk fabrics were used. Both samples were stitched by hand and machine using two types of thread i.e. cotton and nylon. The seam strength of all the samples was tested on seam tester using test method ASTM D-1683-04.

Result

It was observed that hand running stitch possessed better seam strength as compared to machine stitch. Thus hand stitch can be used in place of machine stitching for specific end uses at some places. Hand stitches done with nylon thread on cotton fabric gave the excellent result. Thus hand stitches can be used for structural as well as for decorative purpose.

Keywords: *Durability, Hand Stitch, Machine Stitch, Seam, Serviceability*

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1. Introduction

India is rich in varied traditional hand crafted products. Numbers of people are skilled in hand stitching [7]. These skills are imbibed by succeeding generations through a cultural tradition and legacy but are not able to compete with the machines and so are losing on employment and recognition. Good design with proper use of hand stitching skill to produce quality product will help in generating employment to such a larger sector where people know and can afford hand stitch only.

Hand stitching is one of the oldest construction techniques and continues to be superior for finishing high-value and bespoke items even today. Stitching by hand is still prevalent in India, but only at household level. Fall on the sari and finishing on the edge of the dupatta and stoles are the common examples of hand stitching. There is a need to support and popularize this skill for sustainability. Good design incorporating hand stitches can be used for this purpose. The hand stitched techniques explored to construct garment will allow the designer and skilled people to experiment with a range of materials from conventional to cutting – edge where in hand seam can be used not only for decorative aspect but also for structural designs.

Apparel is the conversion of a two dimensional fabric into a three dimensional product. Seam is one of the important parameter and considered as basic requirements in the construction of apparel [5]. Its quality had great significance in the production of finished apparel products. Quality and Serviceability are the two principle components of apparel. Quality can be defined by the workmanship, material, acceptable design, and comfort in the apparel [3]. Serviceability depends on the structural construction of the garment of which seams play an important role.

A seam is a joint between two pieces of fabric and gives the shape of the apparel for wear [7]. Consumers evaluate seam quality mainly based on the seam appearance and its durability after wear and care procedures. Various types of seam, stitches can be applied on finished fabric (garment) with different stitch density (SPI) having diverse effects on the seam strength, quality in general and performance in particular. The Probability of the seam performance for different garment is also different depending upon the end use [2]. Machine stitching ensures a consistent and repeatable joint at higher speeds than sewing by hand. Since the invention of the sewing machine, hand techniques are reserved either for repairing or temporary or for the highest quality applications and for elements of construction that machine still are not capable for a finished apparel product.

Durability of clothing is most important which is determined by the strength of seam [1]. Many studies have been carried out on the parameters which affect the seam efficiency, but there is still a gap of reported research work regarding the effect and comparison of hand stitching with machine stitching for better strength of the seam construction for apparels.

There are many factors which affects the seam strength. Seam appearance and performance depends on the type of fabrics, thread, and stitch type, type of seam and sewing parameters, which includes the needle size, stitch density, the appropriate operation [4]. The quality of seam can be examined from two main aspects: functional and aesthetic performance. The functional performance of the seam is mainly in terms of the strength and efficiency of the seam [6]. The visual and functional requirements of the apparel are mainly visualized through the performance features. Visual requirements are based on the patterns, design, colors, trends and accessories. The functional requirements are more associated to the durability of the apparel end use. The seam enhances serviceability and durability for functional performance of the fabric [9]. Both functional and aesthetic performance of an apparel product in terms of durability and stability are affected by seam strength.

Tensile strength and seam properties are the key performance indicators for final apparel to be fit for the end use [7]. Seam efficiency has been defined as the ratio of seam strength to the strength of the fabric in-sewn expressed as the percentage of the fabric strength [8]. In hand stitching, there are many types of stitches each one has evolved for a particular function and appearance. They may be visible and matched or contrasting depending on the desired effect, or concealed within the hem. In this study, seam strength of woven fabrics was studied for seam by machine and hand.

2. Material and Method

2.1 Materials

Woven fabric – cotton and silk of light weight with a 73 GSM and 43 GSM respectively were used to test the seam strength. The cotton and silk fabric were procured from Local market. The specifications of the fabric are given in Table1. For hand as well as machine stitch samples cotton and nylon thread with the specification given in Table 2 were used.

2.2 Method

The samples were cut in size of 14inches x 4 inches, by using ASTM D-1683-04 to test the strength of seams in woven cotton and silk fabrics. Plain seam was done by machine and running stitch by hand. Both for hand and machine sample, cotton and nylon thread were used. For each sample stitching was done leaving a seam allowance of 0.5 inches at the edge using a stitch type 301 and density of 12+- ½ stitches per inch. For testing strength of the seam tensile strength tester with test method D 5034 conforming to specification D 76, and a constant rate of extension capable of jaw separation rate of 12.0 +- 0.5 in./ min was used.

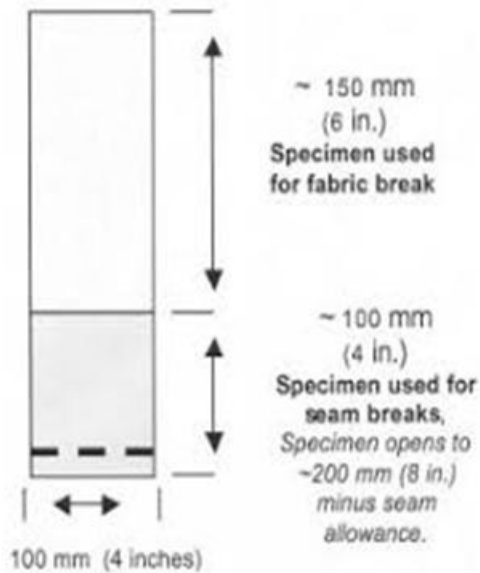


Figure 1- Seamed specimen size and placement in clamps

3. Result and Discussion

3.1 Preliminary data of the fabric

Fabrics used for the study were tested for its preliminary data.

Table 1: Preliminary data of the fabric

Fabric	Weave Type	Weight per unit areas	Fabric count (In Inches)		Yarn count		% of Drape Coefficient	Thick ness	Tearing strength	Tensile Strength	Cover Factor
			EPI	PPI	Warp	Weft					
<u>Mulmul</u>	Plain	73	28.76	25.25	18	16	0.15	0.80	63	17.32	28
<u>Tussar Silk</u>	Plain	43	13.36	6.42	25.6	50.6	0.28	0.12	42	10.26	16.64

3b. Preliminary data of the yarn used for hand and machine stitch:

Yarns were tested for the preliminary data using the formulas given below:

- I. **Ticket number** = Resultant count(RC) x 3, where RC is yarn count and number of plies
 - II. **% Shrinkage** = $\frac{\text{Elongated length} - \text{Original length}}{\text{Original length}} \times 100$
 - III.
 - IV. **Diameter** = $1/28\sqrt{Ne}$
- Thread used for experiment were with specification given as below.

Table 2: specification of thread used for the construction of plain seam

Yarn	Ticket No.	Twist/inch	Ply	Diameter	Tensile strength	Tex
Cotton	30	Z(103)	2	0.26mm	0.46 kg	51.6
Nylon	26	S(65)	2	0.28mm	1.74 kg	57.2

The strength of stitches on cotton and silk fabric was tested for both hand and machine

3c. Results of the test on cotton fabric are given in table below

Table 3: Strength of seam on cotton fabric

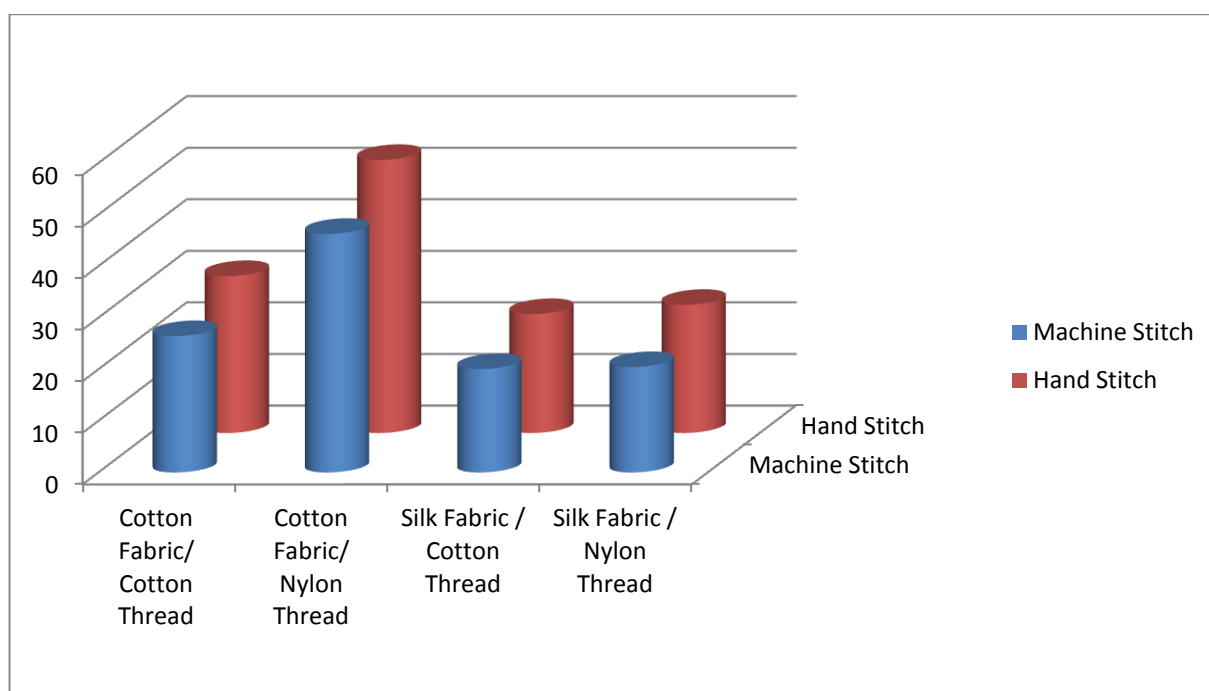
Fabric	Cotton thread (kg)		Nylon thread(kg)	
	Hand Seam	Machine Seam	Hand Seam	Machine Seam
Cotton fabric	30.44	26.45	52.96	46.28

From table 3, it was observed that hand stitched samples showed better results in both cases as compared to machine stitch sample. Thread used for stitching also plays an important role. Strength of samples stitched with nylon thread showed better results for both hand stitch and machine stitched samples. For samples stitched with cotton thread on cotton fabric hand seam showed strength of 30.44 as compared to machine stitched sample which showed strength of 26.45. Hand seam is stronger than machine seam here. With the nylon thread on cotton fabric hand seam exhibited strength of 52.96 whereas machine seam exhibited strength of 46.28 which is less than hand stitch sample. Seam of the sample with nylon thread was stronger than the samples with cotton thread. Difference between the cotton thread and nylon thread samples in hand seam showed much difference which was also observed in machine samples.

Table 4: Strength of seam on silk fabric

Fabric	Cotton thread (kg)		Nylon thread(kg)	
	Hand Seam	Machine Seam	Hand Seam	Machine Seam
Silk Fabric	23.07	20.05	24.85	20.44

From table 4, it was concluded that hand stitched samples showed better results in both cases as compared to machine stitch sample. Strength of samples stitched with nylon thread showed better results for both hand stitch and machine stitched samples. For samples stitched with cotton thread on silk fabric hand seam showed strength of 23.07 as compared to machine stitched sample which showed strength of 22.05. Hand seam was stronger than machine seam here. The pattern was same as observed in case of cotton fabric. With the nylon thread on silk fabric hand seam exhibited strength of 24.85 whereas machine seam exhibited strength of 20.44 which is less than hand stitch sample. Samples with nylon thread were stronger than samples with cotton thread. Cotton thread hand and machine seam showed better strength than nylon thread samples for both hand and machine seam



Graph 1: Breaking strength of the seam

In graph 1, X-axis shows the samples and Y-axis shows the strength of each sample. From the graph it was concluded that hand stitch is stronger than machine stitch in all the four cases.

The maximum strength of the machine seam sample was in the case of cotton fabric with nylon thread whereas minimum was in case of silk fabric with cotton thread. For hand stitch samples also the maximum strength observed was in the case of cotton fabric with nylon thread whereas minimum was in case of silk fabric with cotton thread. Out of the samples tested, the seam done by hand using nylon thread on cotton fabric showed the best result.

4. Conclusion

From the above it was concluded that for plain seam hand stitch sample showed better strength than machine stitched samples for both cotton and silk fabric. There was difference in the seam strength on cotton and silk fabric. Cotton showed better results than silk fabric. Difference in strength with cotton and nylon thread was observed on same type of fabric. Samples with nylon thread showed better results. For better seam strength the combination was use of nylon thread on cotton fabric with hand stitching. It is not only the type of base material and type of stitch but also the type of thread influence the strength of the seam. Wherever machine seam generally fails hand stitching can be used. Garments can be made by hand stitching if speed of machine is incomparable. Designs made with hand stitch in combination with machine stitch can be explored.

5. Recommendation

In this sustainable movement scenario, people are experimenting with new methods which are environmentally safe, sustainable and innovative as well. The shift from machine to hand stitching for innovative designs can be one of the methods towards sustainability giving opportunity to people who do not have investment capacity for machine but possess skill. There can be further study which can be carried out on the different types of seams used to strengthen the seam using hand stitching. It can be explored to be used for construction, surface ornamentation and both for innovative designs. People who are not working as professional in the field of design but are skilled with hand stitching will be benefitted with this kind of projects.

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