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EXISTING SURGICAL GOWNS;
IMPACT OF LAUNDERING ON TENSILE STRENGTH TEST RESULTS

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ABSTRACT… Textiles perform as an interface between the body and environment. In the new generation of textiles, this potential of textiles is being utilized to provide the resistance not only against weather but also against micro-organisms and collision forces etc. the type of weave has a strong impact on its physical properties. Type of weave also affects the suitability of the material end use. According to a study by Behera plain weave is more suitable for surgical apparels in comparison with twill weave because of large pores between two adjoining yarns on intersection. Fabric construction parameters determine the strength of the fabric. Parameters are: mass per unit area, number of threads per unit length, maximum force using the strip method, & yarn count (yarn number). A fabric with high thread count does not allow the microorganisms to pass through a fabric than a fabric having low/less count. Different Surface finishes help to decrease the bacterial growth on the surface of fabric. Plasma coated Non-woven samples are better repellent of pathogens than re-usable woven fabrics. All surgical attire has to meet some given standards for tensile strength which dictates the rate of wear and tear that will affect the required properties. The thought behind this study was to evaluate and compare the tensile strength of existing surgical gowns among the groups. **Objectives:** 1) To find out the Tensile Strength of existing surgical gown fabric before and after laundering (among three groups of hospitals). 2) To compare the results of Tensile Strength of existing surgical gowns (among three groups of hospitals) being used in hospitals of Lahore. **Study Design:** The study has experimental design. **Period:** March 2011- March. 2012. **Materials and methods:** Samples of fabric used for making surgical gowns were collected from different hospitals of Lahore and evaluated for Tensile Strength before and after laundering at Textile Lab. **Result and Conclusions:** On the whole a decreasing trend was observed for tensile strength in all 3 groups of hospitals from 0 to 20th laundering. Group B of hospitals showed lowest tensile strength observation whereas the highest value was observed in group A of hospitals. The lowest observation for tensile strength was found in Group B of hospitals whereas in group C the highest value was observed it's clear that fabrics of group B showed lowest tensile strength rating in test results for both warp and weft directions. Whereas group A of hospitals showed highest tensile strength test results among the groups in warp and in weft group C showed high results.

Key words: Surgical apparels, existing surgical gowns, transmittable infections, Tensile strength.

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INTRODUCTION

MATERIALS & METHODS

An experimental study was designed to evaluate the Tensile Strength of surgical gowns currently being used in various hospitals of Lahore city. Total fifteen hospitals were selected. The sample was selected randomly and categorized into three groups A, B, & C on the bases of socio economic condition of the patients.

Tensile strength Test (Determination of Maximum Force Using the Strip Method)

All the samples of existing and experimental surgical gowns were collected & evaluated for tensile strength following. For this purpose, from each sample two sets of test specimens were slashed. First set was slashed from warp yarn side and the second in the weft. No test specimens were cut out from within 150 mm of either edge of the laboratory sample. No test specimen were taken from the warp direction contained the same longitudinal threads and no test specimen taken from the weft direction contained the same picks. The width of each test specimen was 50 mm ± 0,5 mm (excluding any fringe) and its length was long enough to allow a gauge length of 200 mm. Each test specimen was cut with its length parallel to the warp or the weft of the fabric and sufficiently wide to allow the essential border. Yarns were removed in more or less the same in numbers from each of the long edges of the cut strip until the width of the test specimen was 50 mm ± 0, 5mm (excluding any fringe).[1]

The width of the fringes was such that during testing no longitudinal threads run away from the border. The gauge length of the tensile testing machine was set to 200 mm ± 1 mm as elongation of fabrics at maximum force was up to 75 %. The rate of extension or elongation of the tensile testing machine was set to 100 mm/min as a function of the elongation at maximum force of the fabric. Test specimens were fixed loosely i.e. with a pretension of just about zero power. Test samples were clamped from center so that its longitudinal Centre-line passed through the center point of the front ends of the clamp. A gadget for observing the highest reading was engaged. The movable clamp was put in motion and extended the test specimen to the point of rupture. The maximum force was recorded. The test was performed on at least five test specimens of each fabric direction. The arithmetic mean of the maximum force was calculated in Newton for each direction tested.[2,8]

RESULTS

Maximum Force (Tensile strength) using the Strip Method (Warp)

All surgical apparel must meet some standards for tensile strength which dictates the rate of wear and tear that will affect the required properties (18&19). ASTM standard for tensile strength is ASTM-D 5034.[1,4]

	Groups	N	Mean	SD
Tensile Strength using the Strip Method (Warp) (New Gown)	Group-A	5	605.39	119.23
	Group-B	5	546.91	106.65
	Group-C	5	600.69	75.28
Total		15	584.33	98.41
Tensile Strength using the Strip Method (Warp) (05-laundering)	Group-A	5	630.96	91.47
	Group-B	5	532.54	106.18
	Group-C	5	597.34	78.85
Total		15	586.94	95.79
Tensile Strength using the Strip Method (Warp) (10-laundering)	Group-A	5	607.74	84.05
	Group-B	5	514.40	116.73
	Group-C	5	598.82	99.20
Total		15	573.65	103.05
Tensile Strength using the Strip Method (Warp) (15-laundering	Group-A	5	598.78	97.37
	Group-B	5	496.12	124.20
	Group-C	5	503.36	129.31
Total		15	532.75	119.33
Tensile Strength using the Strip Method (Warp) (20-laundering)	Group-A	5	552.18	74.17
	Group-B	5	472.10	119.27
	Group-C	5	526.80	72.20
Total		15	517.02	91.23

Table-I. Descriptive Statistics for Tensile Strength (in Newton) using the Strip Method (Warp) at different laundry intervals (Existing surgical gowns)

Factor (p-value) = 0.000(Significant: p-value<0.05)

Mean Tensile Strength using strip method (warp) for all samples was given in above table from new gown to 20th laundering in 5-laundering intervals. The average Tensile Strength (warp) for group A was observed to be 605.38±119.23 at 0 Laundering, 630.96±91.47 at 5th Laundering, 607.74±84.05 at 10th Laundering, 598.78±97.37 at 15th Laundering and 552.18±74.17 at 20th Laundering. These average values for Tensile Strength using strip method (warp) in Group B were observed as 546.90±106.65, 532.54±106.18, 514.40±116.73, 496.12±124.20 & 472.11±119.37 in that order. Within Group C, the mean readings Tensile Strength using strip methods (warp) for all intervals were observed as 600.58±75.28, 596.34±78.85, 598.72±99.20, 503.37±129.31 and 526.80±72.20 in that order. Maximum force Mean for new gown and 20th laundering were 574.32±98.41 & 517.02±91.12 in that order.

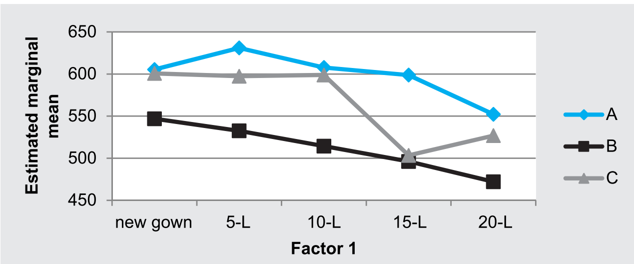

Figure-I. Tensile Strength Using the Strip Method (Warp) at different Laundry Intervals
*Factor*Group (p-value) = 0.458 (Insignificant: p-value>0.05)*

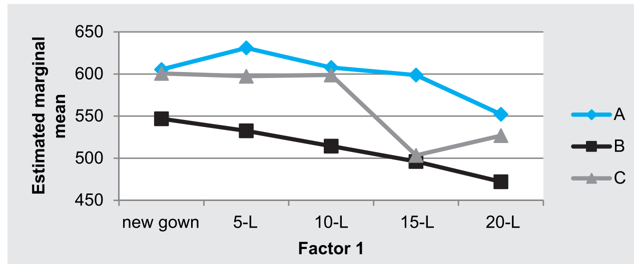

Figure-II. Tensile Strength Using the Strip Method (Weft) at different Laundry Intervals
*Factor*Group (p-value) = 0.100 (Insignificant: p-value>0.05)*

	Groups	N	Mean	SD
Tensile Strength using the Strip Method (Weft) (new gown)	**Group-A**	5	330.80	46.66
	Group-B	5	350.16	66.64
	Group-C	5	395.38	36.54
Total		**15**	358.78	55.29
Tensile Strength using the Strip Method (Weft) (5-laundering)	**Group-A**	5	322.04	60.26
	Group-B	5	339.52	68.86
	Group-C	5	384.64	42.18
Total		**15**	348.73	60.38
Tensile Strength using the Strip Method (Weft) (10-laundering)	**Group-A**	5	318.32	64.71
	Group-B	5	325.54	66.73
	Group-C	5	374.06	44.50
Total		**15**	339.30	60.75
Tensile Strength using the Strip Method (Weft) (15-laundering)	**Group-A**	5	325.78	135.53
	Group-B	5	296.72	61.73
	Group-C	5	313.36	91.30
Total		**15**	311.95	94.18
Tensile Strength using the Strip Method (Weft) (20-laundering)	**Group-A**	5	304.76	117.51
	Group-B	5	266.02	73.53
	Group-C	5	324.34	39.86
Total		**15**	298.37	81.07

Table-II. Descriptive Statistics for maximum force Using the Strip Method (Weft) at Different Laundry Intervals (Existing surgical gowns)
Factor (p-value) = 0.000(Significant: p-value<0.05)

Mean Tensile Strength using strip method (weft) in all study groups of hospitals is given in above table for new gown to 20th laundering. In Group A, the average Tensile Strength (weft) was noted to be330.80±46.66 for new gown, 322.04±60.26 at 5th Laundering, 318.32±64.71 at 10th Laundering, 325.78±135.53 at 15th Laundering and 304.76±117.51 at 20th Laundering. In Group B, these values using strip method (weft) were recorded as 350.16±66.64, 339.52±68.86, 325.54±66.73, 296.72±61.73 and 266.02±73.53 respectively. In Group C of hospitals, these values for all intervals were recorded as 395.39±36.54, 384.54±42.18, 374.06±44.40, 313.26±91.30 and 324.34±39.86 respectively. The combined Tensile Strength for all three groups of hospitals' new gown and 20th laundering was 358.78±55.29 and 298.37±81.07 in that order. According to p-value the variation in Tensile Strength breading (weft) from 0 to 20th laundering was statistically different in the three groups i.e. (p-value=0.000).

DISCUSSION

The Tensile Strength of the fabric was decreased over repeated laundering.[5,9] and this decrease in Tensile Strength was statistically significant from 0 to 20th laundering. i.e. (p-value=0.000). Overall a decreasing trend was observed for Tensile Strength in all 3 groups of hospitals from 0 to 20th laundering. The lowest reading for Tensile Strength was found in Group B whereas the highest value was recorded in group A of hospitals. After 20th laundering, the mean Tensile Strength in Group A, B and C of hospitals was 552.18±74.17, 526.80±119.27 and 472.10±72.20 respectively however, this difference was not important statistically. i.e. (p-value=0.458). The declining trend of Tensile Strength indicates that fabric is losing its strength and becoming weaker because during wear and laundering abrasion removes the fur/lint from the surface layer of fabric and cause it weak and in some situations less dense.[7,11] The cause is repeated washing, use of strong detergents/soaps/ and excessive use of bleaches.[10]

A decreasing trend is observed for Tensile Strength (weft) in all study groups. The overall mean Tensile Strength in all three groups was 304.76±117.51, 266.02±73.53 & 324.34±39.86 in that order. The lowest reading for Tensile Strength was found in Group B whereas the highest value was recorded in group C of hospitals. However, according to p-value this difference or decrease in Tensile Strength in all hospital groups was not statistically significant i.e. (p-value=0.100).This indicates that fabric is becoming less dense.[14] This could be seen that gown fabric of group B was showing poor tensile strength in both warp and weft directions.[16,17] Whereas group A showed highest tensile strength test results among the groups in warp and in weft group C showed high rating.

CONCLUSION

The factor under consideration in this study was the Tensile Strength of existing surgical gown fabric. The existing surgical gowns were collected from fifteen different hospitals under study. These surgical gowns subjected to Tensile strength test to check the strength of the fabric both warp and weft. The result proved that the fabric used for the surgical gowns was not up to the mark and did not show much resistance. The surgical gowns fabric disqualified the entire test. These gowns did not match any international standard or parameter either. Most of the gowns became discolored after repeated laundering. Among three groups under study group A showed highest ratings in warp yarns where as for weft yarns group c was at top.

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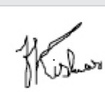
1	Dr. Farzana Kishwar	Main Author	
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