A Study on the Sewing Skill of Curved Lines by Machine Sewing

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Abstract

The operation of hands on the sewing of curved line by electric sewing machine is importance. As the operation of hands is a delicate for the beginners, they need an apt training curved line.

This study developed five sorts of exponential curved lines which resemble the pattern of sleeve top, and investigated about the sewing ability of female students using them.

The results were summarized as follows.
1) The miss score - The sewing velocity diagrams were drawn from the experimental results.
2) It was found from the above diagrams that the sewing velocity of experts at sewing when they sewed sharp curved lines (9 cm, 12 cm, 15 cm wave height) by electric sewing machine were much the same as foot pedal sewing machine’s.
3) Unskilled students sewed sharp curved lines fast. Therefore they were tired very much and their miss scores were increased.
4) To practice the sewing using a gentle curved line (3 cm wave height) have much effect on unskilled adult women.

1. Introduction

Students have learned the sewing skill of curved line by machine sewing in junior high school. However, they often fail to sew the neckline and the sleeve line, because they sew garments without knowledge and experiences enough to sew these curved lines.

It needs much experiences to learn the sewing skill of curved line. It is too hard for beginners to sew accurately along the curved lines by manual operation. Therefore, we have thought that it needs proper guide curved lines to practice curve sewing.

General guide curved lines used for sewing practice are such circles as a tentative plan of fourth grade clothing license with examination. Judging from mental fatigue, interest, and practical respect, they are little worth appropriate guide curved lines.

There are so few research studies on the guide curved lines using for the practice of sewing.

This research was developed for the guide curved lines which resemble the pattern of sleeve top drawn by computer, and the sewing skills of female students using them were also measured.

To guide beginners the effect of their sewing skills were examined.

2. Methods and Procedures

(1) Test subjects

The subject of ten voluntary female students participated in this study.

(2) Sewing material and guide curved line

Slider white paper was used for sewed material because the perforated points of the needle were traced clearly, and the grading was easy.

Guide curved line has been developed resembling the pattern of sleeve top. The form of this curved line was assumed as following formula.

\[ f(x) = K \cdot \left( -\frac{1}{(x-A)^2} + \frac{1}{(x+A)^2} \right) \quad (-A \leq x \leq A) \]

where \((-A \leq x \leq A)\); \(e\): the base of natural logarithm.

The simulation curve driven from this equation could be applicable on the sewing test, because the driven curves A, B,
C, D, E shown in Fig. 1 were simulated to the curved line applied for practical use. When \( A = 25, x = 0 \)

\[
f(x) = Ke^{-x} + \frac{1}{25} \Rightarrow K^x = K\]

Thus, when \( K \) is 3, 6, 9, 12, 15, it was shown in Fig. 1. Five sorts of exponential curved lines were drawn by computer. Guide curved line was shown in Fig. 2. It was drawn as an curve

![Fig. 2. Guide curved line to be sewed](image)

Table 1 Total sewing length

<table>
<thead>
<tr>
<th>Wave height (cm)</th>
<th>Total sewing length (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>250</td>
</tr>
<tr>
<td>3</td>
<td>253</td>
</tr>
<tr>
<td>6</td>
<td>261</td>
</tr>
<tr>
<td>9</td>
<td>278</td>
</tr>
<tr>
<td>12</td>
<td>294</td>
</tr>
<tr>
<td>15</td>
<td>314</td>
</tr>
</tbody>
</table>

Table 2 Sewing time and sewing velocity in straight line 250 cm of the sewing length

<table>
<thead>
<tr>
<th>Subject</th>
<th>Sewing time (sec)</th>
<th>Sewing velocity (cm/sec)</th>
<th>Sewing time (sec)</th>
<th>Sewing velocity (cm/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>197</td>
<td>2.58</td>
<td>53</td>
<td>4.72</td>
</tr>
<tr>
<td>b</td>
<td>85</td>
<td>2.94</td>
<td>52</td>
<td>4.81</td>
</tr>
<tr>
<td>c</td>
<td>100</td>
<td>2.50</td>
<td>67</td>
<td>3.73</td>
</tr>
<tr>
<td>d</td>
<td>124</td>
<td>2.02</td>
<td>54</td>
<td>4.63</td>
</tr>
<tr>
<td>e</td>
<td>81</td>
<td>3.09</td>
<td>53</td>
<td>4.72</td>
</tr>
<tr>
<td>Mean</td>
<td>97.4</td>
<td>2.63</td>
<td>55.8</td>
<td>4.53</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subject</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>f</td>
<td>0.413</td>
</tr>
<tr>
<td>g</td>
<td>0.447</td>
</tr>
<tr>
<td>h</td>
<td>0.446</td>
</tr>
<tr>
<td>i</td>
<td>0.446</td>
</tr>
<tr>
<td>j</td>
<td>0.446</td>
</tr>
<tr>
<td>Mean</td>
<td>0.558</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>1.048</td>
</tr>
</tbody>
</table>

Notes: The difference between Foot pedal sewing machine and Electric sewing machine in A group was admitted to significant level, 0.01. The difference between Foot pedal sewing machine and Electric sewing machine in B group was admitted to significant level 0.01.

Fig. 3 An example of miss marks

(3) The evaluation of experimental results by tracing guide line

There are two procedures to evaluate the experimental results with tracing guide line; The one is using the absolute integrated value of deviation from the guide line and the other is measuring miss marks of 0.1 cm apart from the guide line. In this experiment, we gave one score point to miss marks of the points, which were within from 1 mm and 2 mm, and two score points to miss marks of the points which were within from 2 mm to 3 mm and so on by measuring the highest vertical miss mark width apart from the guide line (see Fig. 3). We thought that the evaluation of experimental results was shown as total sum of miss marks deviated from the guide line.

Figure 4 shows, the relationship between the total sum of miss marks areas and the miss scores from the experimental results. Eight female students and the sixteen schoolgirl volunteer subjects participated in this examination. They sewed slider white papers along a curved guide line with two same peak values of 3 cm and 6 cm by the electric sewing machine without thread.

It was found that there was a linear relationship between the total sum of deviated area and miss score from Fig. 4, so in this research we used the procedure to represent miss score as total sum of miss marks.

(4) Procedure of experiment

Testing sewing machines were Singer 191U of foot pedal type, and that of the electric sewing machine Juki HZL 755. Stitch length was adjusted to 4.5 stitches per 1 cm. The method of sewing without thread was used in the experiment.

In order to avoid the influence of training effect and fatigue upon sewing operation for subject, an experiment with only one step operation was made, giving a rest at every interval of one week.

![Fig. 4. Relation between the total sum of deviated miss marks area and that of miss score](image)
3. Results and Discussion

(1) Ability in straight line sewing

In order to measure the sewing ability of test subjects, they sewed along straight line of 250 cm length according to above mentioned experimental procedure. The measurements of time required and miss scores were shown in Tables 2 and 3. These subjects were divided into two groups by sewing ability. A group was composed of five females who could sew a short piece of work, and B group was composed of five females who could sew a casual wear.

It was shown in Table 2 that individual variation existed, and the sewing velocity of A group was observed speedy on the electric sewing machine, however, some of B was observed speedy, and others were not speedy.

It was shown in Table 3 that the subjects a and e belonging to A group who were observed speedy on the electric sewing machine made higher miss scores. The manual operation in sewing straight line was smoother than that of curved line. We can assume that the faster was the sewing velocity, the bigger miss score made beginners.

(2) Relationship between sewing velocity and wave height

It was shown in Figs. 5 and 6 that two groups were compared with the relationship between sewing velocity and wave height. On foot pedal sewing machine, a little difference was observed between A and B in sewing velocity at the same wave height up to 6 cm, but on electric sewing machine, the sewing velocity of A group was observed faster than that of B group.

It was found that the bigger was the wave height below 6 cm, the less the sewing velocity showed both of groups, and over 9 cm, the sewing velocity was approximately constant to the various wave height.

Further, it was found that at the wave height below 6 cm the sewing velocity of electric sewing machine was faster than that of sewing machine in B group, and over 9 cm it was the same sewing velocity as foot pedal sewing machine. But it was found that the sewing velocity of electric sewing machine was faster than that of foot pedal sewing machine at the wave height over 9 cm in A group.

Therefore, skilled B group sewed at the higher speed on electric sewing machine when the wave height was low, but they sewed at the lower speed when the wave height was high, because the manual operation made it easy.

That is to say, the sewing speed was adjusted to the manual operation when moving the paper along the curved line.

(3) Relationship between miss score and wave height

Miss score and wave height of Figs. 7 and 8 show the effect of sewing ability upon the evaluation of tracing guide line.

It is obvious that the sewing along curved line is more difficult than the sewing along straight line. In both groups it was observed that the higher was the wave height, the bigger became the miss score. It was found that over 6 cm in B group, the miss score of electric sewing machine was a little higher than that of
foot pedal sewing machine, but a big difference of miss score between the two sewing machines were observed in A group and the miss score of electric sewing machine was about two times as high as that of foot pedal sewing machine.

Unskilled A group was not able to make the manual operation at the high speed when wave height was high. Therefore, A group could barely sew at the wave height in 3 cm.

(4) Relationship between miss score and sewing velocity

Figure 9(a) shows the relationship between miss score and sewing velocity. It was found in Fig. 9(b) that skilled B group sewed at the high speed on the electric sewing machine when wave height was low (3 cm, 6 cm). But when it was high (9 cm, 12 cm, 15 cm), the sewing velocity of electric sewing machine was about the same as that of foot pedal sewing machine, because the manual operation was easy to do. Therefore, the miss score of electric sewing machine was same as that of foot pedal sewing machine.

But it was found in Fig. 9(a) that unskilled A subject on the electric sewing machine sewed at high speed, so that the miss score of electric sewing machine was about two times as much as that of foot pedal sewing machine.

Teachers of junior high school, as a rule, have given pupils a test of sewing by using a tentative plan of fourth grade clothing license with examination. As for the sewing time and the evaluation of tracing guide line, they often stated that it was observed that pupils who finished sewing speedily didn't excel in sewing skill and a slow sewer was better evaluated than a fast sewer. This evaluation corresponds with the result of this study.

We, both girls and boys have been learning the operation of sewing machine from at the age of standard fifth grade student of elementary school to at the age of a high school student. But Matsuda and Ishige found that about 34 percent of new
students in their sample (= 1,140) said that they had self-confidence on applying foot pedal sewing machine, and most of them had mastered the sewing skill in their fifth grade of elementary school. Those who master the sewing skill included few grown-up. The difference between skilled student and unskilled student appears clearly from this study.

The point of guidance to master the sewing skill is not to give any mental burden to unskilled women. It is obvious if they sew at high wave height (= 9 cm, 12 cm, 15 cm) applying the guide curved lines to practice, it would only tell them their unskillfulness at their sewing skill and it would make them lose their volition to do.

In order to give them confidence on foot pedal sewing machine, it is effective for them to apply 3 cm wave height as the guide curved line to learn how to control the manual operation and the sewing velocity, and the second step is to make them practice sewing it at the high speed. After practicing how to control the manual operation and the sewing velocity, the third step is to make them sew applying 6 cm wave height as the guide curved line. As described above, the sewing skill of curved line was too hard for unskilled women, therefore, it is necessary for us to provide the educational guidance by applying an appropriate guide curved line to practice.

4. Summary

It is important for us to control the manual operation and the sewing velocity on the sewing skill of curved lines by electric sewing machine. As for the manual operation it is too hard for the beginners to sew accurately along the curved lines. It is necessary for us to make beginners use an appropriate guide curved line to practice curve sewing.

This research was developed with five sorts of exponential curved lines which resembled the pattern of sleeve top drawn by computer, and the sewing skill of female students applying these curved lines was also evaluated.

The results were summarized as follows.

1) The miss score—The sewing velocity diagrams were drawn from the experimental results.

2) It was found from the diagrams that skilled students sewed at the high speed by electric sewing machine when wave height was low (3 cm, 6 cm), but when it was high (9 cm, 12 cm, 15 cm), the sewing velocity of electric sewing machine was about the same as that of foot pedal sewing machine. Therefore the miss score by electric sewing machine was same as that by foot pedal sewing machine.

3) Unskilled students on electric sewing machine sewed at the high speed so that the miss score by electric sewing machine was about two times as much as that by foot pedal sewing machine.

4) In order to give unskilled women the confidence on foot pedal sewing machine, it is effective for them to apply 3 cm wave height as the guide curved line to learn how to control the manual operation and the sewing velocity.

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References

