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Development of Shoe last with convex shape for placing Orthotics in Footwear

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ABSTRACT: Shoe lastis a three dimensional form based upon the shape and movement of the foot. This is an important tool for footwear making. This article aims to give a complete introduction to a shoe last. It starts from basic knowledge of a shoe last. The relationships between different parts of the foot and the shoe last are then explained. Finally, the article introduces the design methods of a shoe last, followed by the manufacturing methods.

KEY WORDS: Sho last, Orthotics, convex shape, custom footwear

I.INTRODUCTION

Almost upper is depend on the last. Most feet have a slight inward curve. Therefore corresponding inward curve in the last will improve fit and comfort. It reviews processes in shoe-last mass customization, including shoe-last design, shoe-last manufacture, shoe-last design framework, design of styling curves for shoe-lasts, and development and selection of shoe-last design. a customized shoe is needed, especially for the person whose foot shape is not normal [1]. The orthopaedic footwear sector based on manual work [2].The products having various sizes and shapes to meet the customer's different tastes or needs are called Custom-made products. So fabrication of custom-made products inherently involves inefficiency. Customized shoes are not an exception because corresponding shoe-lasts must be custom-ordered. It would be nice if many template shoe-lasts had been cast in advance, the most similar template was identified automatically from the custom-ordered shoe-last, and only the different portions in the template shoe-last could be machined. To enable this idea, the first step is to derive the geometric models of template shoe-lasts to be cast. This study evaluates the reduction in peak pressure [3].

In order to enable the design of custom and mass-customizedfootwear,thereisaneedtoimproveandspeed-upshoe-lastdesign and enable custom shoe-last design based on foot biomechanics [4].The two major ones are toe spring and heel pitch, which affect the rocking or pivoting motion of the foot.Sizes are defined by various national and continental sizing systems [5].

The health, comfort and how well different actions of the foot performed in the shoe also depends on the last. It is medically proven that wrong fitted footwear may invites problems such as corn, hook worm, cracks on skin, blister, athletes' foot, arthritis, diabetes, heart trouble, short eye sight etc. So the analysis of foot shape data and shoe last Design we expect to establish a reasonable series of shoe last size system by applying statistic theory to analyze the foot shape data [6].

In the UK, SATRA Footwear Technology Centre recommends a joint girth of 246.5 mm for an average-middle fitting men's last (the average foot girth corresponding to this size/fitting is *250* mm), and a joint girth of 214.5 mm for an average-middle fitting women's last (the average foot girth corresponding to this size/fitting is 226 mm).[7] In recent years, with the rapid development of computer technology and advanced design and manufacturing technologies such as CAD/CAM, to automate the manufacturing process of customized shoe lasts becomes possible[8].

In our country, diabetic has become a pestiferous phenomena. The increasing number of diabetic patient as well as orthopaedic patient and their foot care awareness along with fashion orientation increasing day by day. So there is an

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ample requirement of diabetic shoe and to design this footwear last design is crucial and principal task. So there is a huge requirement of last for the diabetic footwear manufacturing industry.

II. METHODOLOGY

In this study a convex shape shoe last was develop using innovative methods where several steps have been considered. There are two ways to design the last bottom gauge; copy from the original and created by our self. In this lesson at first, we have been copied from the original shoe last and match between the foot data and the existing shoe-last data. Then the basic model is confirmed and developed. The shoe-last bottom, shoe-last bottom outline, shoe-last profile and shoe-last cross-sections are considered while building the basic model. Last bottom gauge designing comes out before last developing. The last bottom gauge determines almost all features and dimension of the last, such as last bottom length, width and angle etc. also to set up last centreline, heel centreline, ball width and seat width is necessary. Once the basic model has been created, the model is generalised for different heel height; the toe and the heel can be designed; and custom shoe-last has been generated [4].As a pair of diabetic footwear, there are required different special features and orthopaedic footwear requires different shape with demand of different shape and size (convex) last. Therefore, the following characteristics have been incorporated in the developed last-

a) Convex shape in the bottom of last for placing orthotics.
b) Designing shape as like as arch of human foot.
c) High adjustment for placing different foot bed with different thickness.
d) Special care of back height considering different leg size.

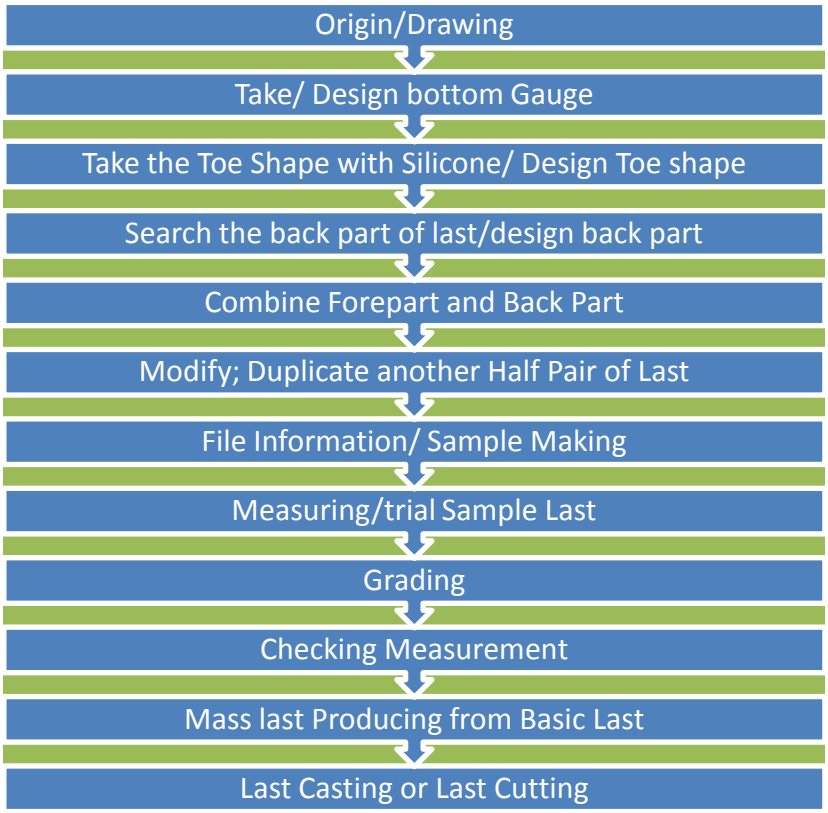

Figure1: Flow chart of making convex shape shoe last

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III. EXPERIMENTAL RESULTS

This convex shoe last has been developed using MyLast software at Step Shoe Last and Accessories limited, Narsingdi, Bangladesh and Leather Research Institute, Bangladesh Council of Scientific and Industrial Research, Dhaka, Bangladesh. Grading to one size to another the Major shoe size specification systems chart has been followed [6]:

System name	Foot length increment	Joint girth increment	Bottom width increment
French	6.67	5.00	1.67
British	8.46	6.35	2.12
USA	8.46	6.35	2.12
Japan	10.00	7.50	2.50
Mondo point	7.50	Unspecified	2.80
Taiwan	3 or 6	4 or 5	6

Table 1: Major shoe size specification systems. The unit of size interval is mm

Last size: Different UK size -7 (Men); EU size - 41
Type: Solid block.
Materials: HDPE (high density poly ethylene)
Length Increment: 8.48 mm
Ball Girth Increment: 6.66 mm

Technical Features	Measurement
Bottom Length	271 mm
Ball Girth	246.7 mm
Thread Point	173mm
Ball Width	100mm
Seat Width	70mm
Last Inward Curve	10^o
Instep Girth	265mm
Back Length	180mm
Cuboids	77mm
Heel Height	8mm
Toe Spring	22mm
Wedge Angle	5^o

Table 2: Developed Shoe Last Measurement

Technical Features	Measurement
Bottom Length	271 mm
Ball Girth	247 mm
Thread Point	173mm
Ball Width	100mm
Seat Width	70mm
Last Inward Curve	7^o
Instep Girth	266mm
Back Length	180mm
Cuboids	71mm
Heel Height	5mm
Toe Spring	21mm
Wedge Angle	7^o

Table 3: Conventional Shoe Last Measurement

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In table 2 Last Inward Curve angle is $10^{o}$where in the conventional shoe last is 7^{o}that means the arch shape of the last matching with the foot shape. Naturally, the foot shape Inward Curve angle is between $9^{o}$to 11^{0} [5]
So, foot can be placed perfectly in the footwear. Cuboids shape also more than conventional one; it helps the heel to place firmly. Ball girth, Thread Point, Ball Width, Bottom Length, Back Length, has been almost same. It means these points are not changeable.

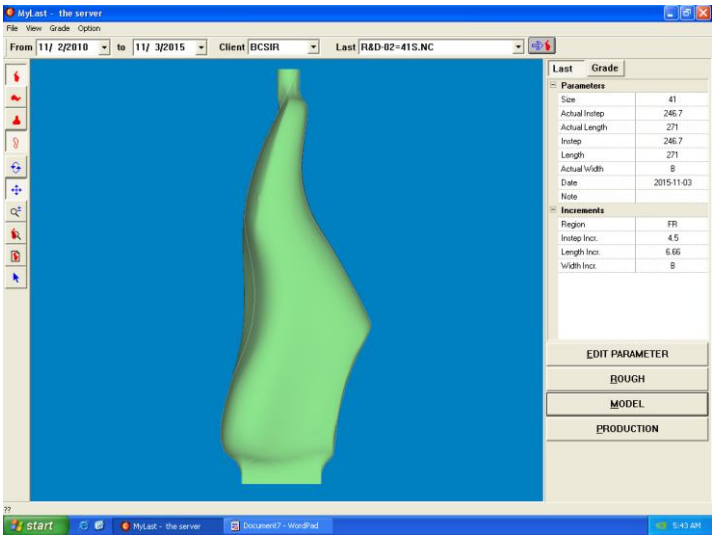

Figure2: Side View of Convex Shoe Last

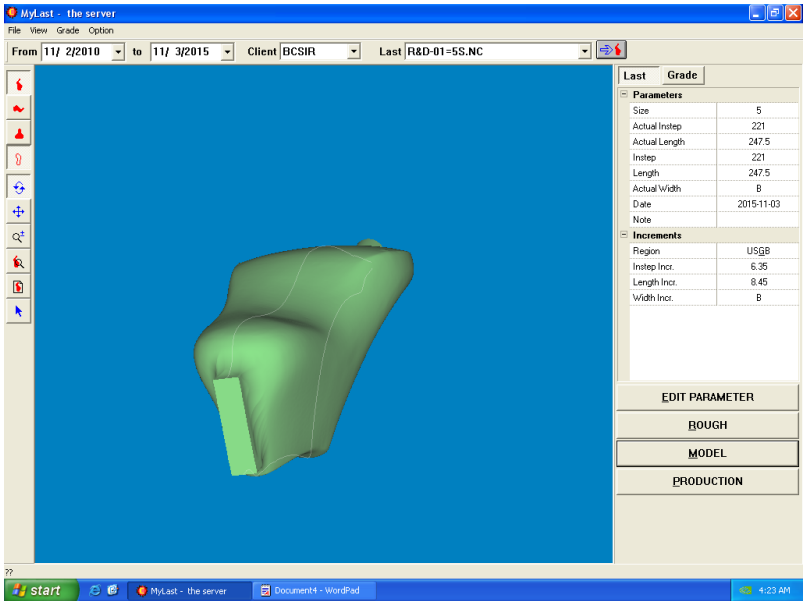

Figure 3: Bottom View of Convex Shoe Last

In Figure2 and Figure 3 the bottom shape of the developed last is deep; it will help the foot placing perfectly in the footwear. The arch of the foot and last seen same. So it makes the footwear comfortable.

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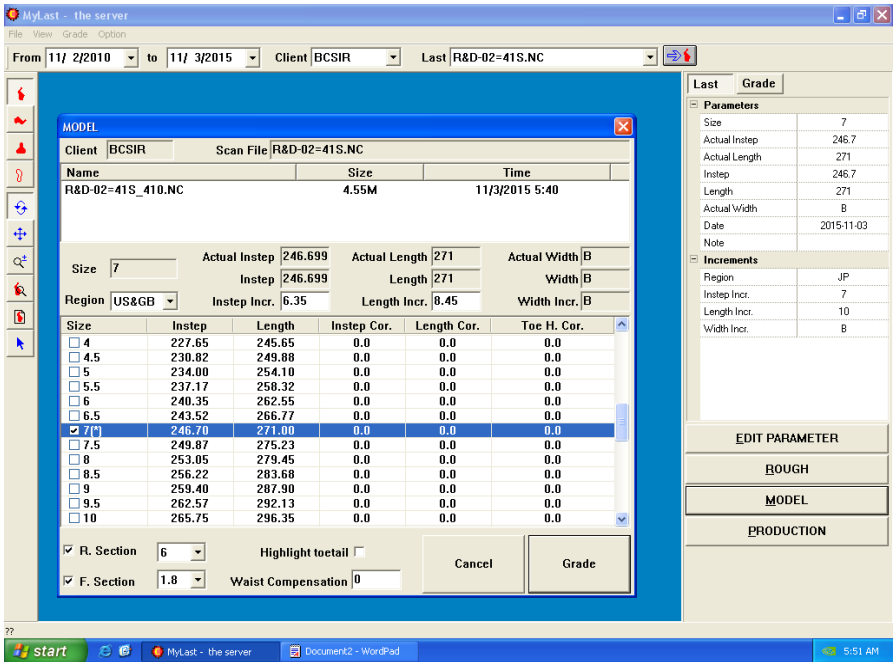

Figure 4: Measurement parameters using MyLast Software

IV. CONCLUSION

In this study, the measurement of dimension changed slightly and hence the fittings also changed. Also a new development system to ensure new shoe-last through this method has been developed. Through this system a new shoe-lasts can be developed by slight variations in parameters automatically. In addition, the shoe last can be visualized and modified accordingly. Since the shoe-last developed in this system is based on the current knowledge of foot biomechanics, it enables better shoe fitting and comfort. This system enables shoe-last designers to create shoe-last of different toe styles, heel heights and heel bottom styles quickly and accurately. The developed Last is specially designed for the manufacturers who want to make customized footwear i.e. diabetic shoe or orthopaedic shoe. So manufacturers of Customized footwear can use this shoe last without any doubt.

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