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Force Analysis of the Support Belt and Pregnant Woman for Relieving the Pregnancy-related Waist Pain ⋆

Xue-lian Kang, Bo-An Ying*, Xin Zhang, Jing Qi, Long Wu

Apparel & Art Design College, Xi'an Polytechnic University, Xi'an 710048, China

Abstract

Researching the waist support belt becomes more important. It's said that the waist support belt can help pregnant women to relieve pregnancy-related pain, but the function of support belt couldn't be unanimously identified by studies or clinical trials' confirm at present. In this paper, the force analysis model is established, aiming to detect the role of the waist support belt. Aiming at the dressing effect is not prominent, when pregnant women just wear the waist support belt. In the paper, analyzing the pain causes of the pregnant women's waist by the theory of mechanics is the basis of research. Through force analysis, it is effective to know how the support belt plays the role. Then, data by pressure test is used to understand the effect, if the support belt can relieve the waist pain of pregnant women. The result is used to verify the results of force analysis. And the data of pressure can explain its functionality. It provides a evaluation method of waist support belt through force analysis and pressure test.

Keywords: Force Analysis; The Support Belt; Relieve the Pregnancy-related Waist Pain; Pressure Test

1 Introduction

At present, the pregnancy-related waist pain is becoming one of the most common problems. According to current consumption and medical situation, it's generally recommended that pregnant women should wear the waist support belt to reduce pregnancy-related discomfort and get a life of high quality. The waist support belt, as the functional clothing, can be worn in everyday life. Then pregnant women can alleviate waist pain and support pregnant life with great convenience and comfort experience. It's significant to improve the product design and evaluation by force analysis. Analyzing the causes of the pregnancy-related waist pain by the theory of force can help designers and users have a clearer understanding of the function of the waist support belt.

The waist support belt is becoming more and more important for the pregnant women to relive pain. At present, some studies on the waist support belt and pregnancy-related waist pain are as follows both home and abroad. In term of survey, 10%-25% of women have pregnancy-related

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*Corresponding author.
Email address: yingba2006@163.com; 1789424568@qq.com (Bo-An Ying).

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waist pain, which is usually the first symptom for the most pregnant women during pregnancy [1,2]. The risk of pain for women who had lumbar pain maybe increases by two times [3]. Ya-zhen Pan researches on the situation in China, which has found that the prevalence of low back pain is 72.7%, 71.7% is reported by Wang and 68.5% is reported by Mogren, which all illustrate the incidence of pain is high [4-6]. The symptoms of pain often interfere with work, daily activities and sleep [7], and severe pain may need crutches, wheelchairs, or even completely bedridden [8,9]. According to a Swedish study, the cost including the treatment for pregnant waist pain and the maternity leave, is estimated to be 25,500 million dollars every year [10], but the pain cannot be completely cured, and may affect the future life.

Researchers have studied the causes of the waist support belt and pregnant waist pain. Cheng-xian Song and others introduce the causes and treatments of pregnancy-related waist pain during pregnancy [11]. Zi-qing Liu, Chao-yang Duan and others believe that uterus grows, the body weight of women and the lumbar angle increases, center of gravity moves forward, the focus on axial load of the lumbar metastases, intervertebral disc is compressed, lumbar back muscles are passive compensatory and in a state of continuous tension and fatigue, and body strength is imbalance before and after, so which cause pregnancy-related waist pain during pregnancy[12]. Foreign scholars have done a lot of researches on the waist pain of pregnant women, which is mainly about the causes of the waist pain and the measures to relieve the waist pain of pregnant women. Ritchie, J. R., Borg-Stein, J. and et al have shown that the lumbar lordosis increases due to excessive protruding during pregnancy, which causes pregnancy-related waist pain [13,14]. And the increased weight mainly concentrates on baby, and the center of gravity turns to 2/3 of the front abdomen, and the center of weight leads to a downward trend. In order to restore the center of gravity, the pregnant women involuntarily arch their upper body and low extremities. Excessive protruding can affect the load distribution of the spine and result in abnormal mechanical stress, so muscle and lumbar ligament are strain, and what can result in the waist pain [15,16]. Fast A has discovered adjuvant therapy such as exercise, adjuvant therapy and the waist support belt can slow down waist pain of pregnant women [17]. Damen, L. and Spoor, C. W. et al find that waist support belts provide a stable external force to the spine and abdominal structure of pregnant women to relive the pain [18,19]. The functionality of waist support belt has not been verified by peer review or clinical trials. A small number of studies show the waist support belt cannot relive the waist pain.

The main works are including as following in this paper. Studying the cause of pregnancy-related waist pain during pregnancy by force analysis is basic. Analyzing the function of waist support belt by force analysis, when pregnant women only wear the waist support belt, can determine whether help pregnant woman relieve the pain. When pregnant women wear waist support belt, testing pressure can judge whether the force analysis is reasonable. The function of the waist support belt is explained by the method of force analysis, and the evaluation method is provided in this paper.

2 The Factors of Waist Pain in Pregnant Woman

In the paper, the increased weight is assumed to be only on the abdomen during pregnancy, so the force analysis of pregnant is only on the upper part. At the same time, it is assumed that the weight of pregnant woman will not changed after the baby is born.

The factors of pregnancy-related waist pain are considered as the force acting on the waist