

## Performance Evaluation of Mechanical Power Lumbar Support for passenger seat

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**Abstract.** In this study, performance evaluation of mechanical function of kinematical 4-way motor-controlled power lumbar support as applied on seats of recent brand-new cars are studied experimentally. The applied model is installed to the seat in new car manufactured in Korea. Firstly static load test is measured how much is dropped off when weight changes. As result, the amount of -15.6 mm projected was gotten when 15kgf is given and -30.0mm was projected when 30kgf of it was given. And the body pressure distribution have been measured according to each condition and observed how much it actually affects tempress. And through that it was confirmed that pressure is evenly distributed between body and seat once lumbar support was installed and therefore the driver can experience a good feeling of comfort when driving.

**Keywords:** Lumbar Support, passenger seat, 4-Way Power

### 1 Introduction

The car seat design concept observes safety, comfort, convenience, and design itself. So unlike other usual seats, it reflects ergonomics and emotional engineering in depth.[1-2] The parts whereby we feel tired and the parts that affect our comfort are the neck, the shoulders, the lumbar and the hips. Among these, the pose and feeling of lumbar are what matter the most. The lumbar support is to support pressure taken on our back and to relieve fatigue that is caused by long-time driving. Lumbar support supports pelvis and prevents it from advancing through back and also to maintain steady the vertebrate and even the upper body. 75% of weight is usually supported by buttocks and especially, 35% of weight is concentrated on tuberosity of ischium.[3-4] The car seat design concept observes safety, comfort, convenience, and design itself.

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The lumbar support is to support pressure taken on our back and to relieve fatigue that is caused by long-time driving. Lumbar support supports pelvis and prevents it from advancing through back and also to maintain steady the vertebrate and even the upper body. 75% of weight is usually supported by buttocks and especially, 35% of weight is concentrated on tuberosity of ischium. When we look at the body pressure distribution measurement, the distribution differs depending on the angle of display stand and the board of the back and the overall pressure value must be kept lower by enlarging surface. Long-time driving interferes with blood circulation of lower body and swells the feet. Seating in a car for two hours continuously is proven to provoke 2.8% of feet swelling. When we assess how driver feels comfort on chair, we usually use body pressure distribution measurement between body and seat surface. Body pressure distribution measurement is performed by using data of driver's distributed pressure through Pressure Matrix.<sup>[5]</sup> As you see in figure 1. When seated on seat with lumbar support, the pressure is evenly distributed on lumbar vertebrae. However, when not, it is pressured by concentrated weighted. Lumbar support has been produced with massage function added and more than 20% of markets have been growing up annually. The lumbar support installed in custom cars has been supplied in 80% of markets worldwide, especially with independent technique in Co. L&P in Canada. Nowadays, we use 4-Way Power Lumbar Support, a motor-controlled device.

## 2 Experimental method and result

In this study, we have performed functional analysis on function of kinematical 4-way motor-controlled Power Lumbar Support as applied on seats of recent brand-new cars. As in figure 1, we have installed the applied model to the seat in new car manufactured in Korea. As in figure 2(a), the static load test was measured how much is dropped off when weight changes. As result, the amount of -15.6 mm projected was gotten when 15kgf is given and -30.0mm was projected when 30kgf of it was given. And maximum deviation was measured 8mm when we gave and retrieved weight. For the following, we have performed h/point test to measure maximum projection of lumbar support when it is set in each different heights. H.POINT test device was expressed as in figure 3 and the conditions we have observed in installation were that slope angle of backseat is 23°, then 3 points each by lowest (p1) part, middle (p2) part, and upper (p3) part were measured to get to know how much is projected. As result, it was 24mm in p1 when no weight was given, and was 33mm in p3. However, when 30kgf of weight was given on it as in figure 4(a), we notice that it goes 6mm, 13mm and 17mm respectively in p1, p2, p3,. Finally, we have measured the body pressure distribution according to each condition and observed how much it actually affects temptress. And through that it was confirmed that pressure is evenly distributed between body and seat once lumbar support was installed and therefore the driver can experience a good feeling of comfort when driving.

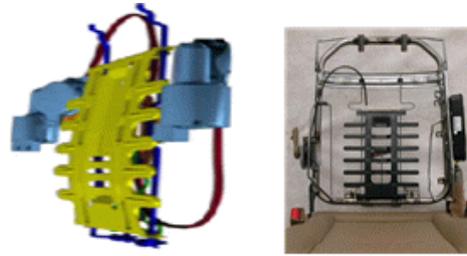


Fig. 1. The structure of the mechanical power lumbar support.

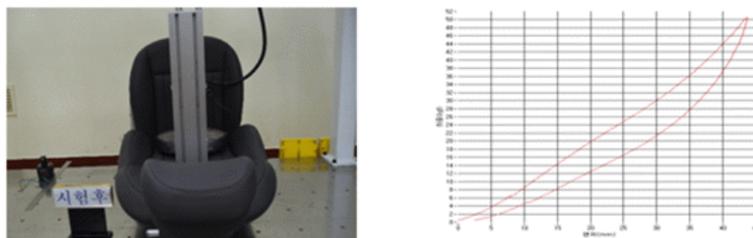


Fig. 2. Static load test apparatus and the test results.

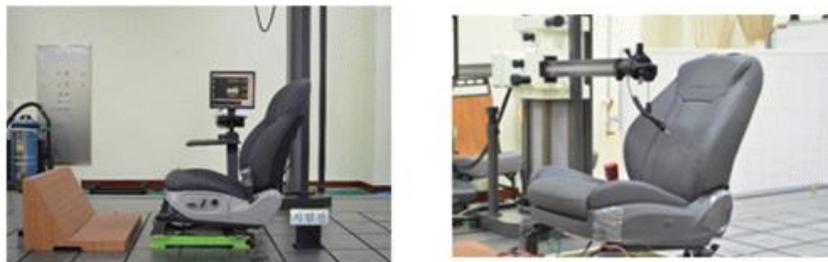


Fig. 3. Experimental measurements for the h / point.

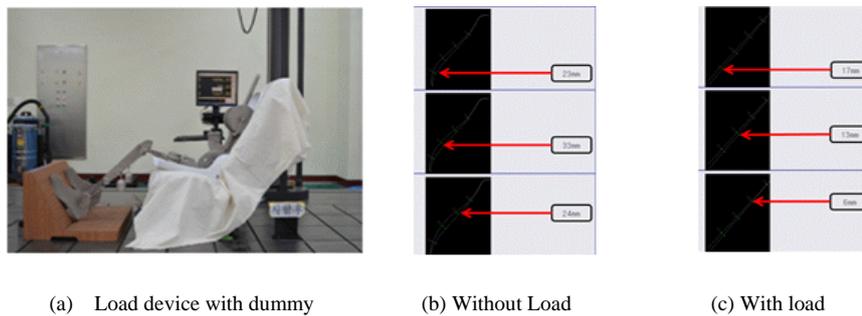


Fig. 4. Results of the modal test.

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