

SUSTAINABLE DESIGN FOR MOTORCYCLIST ERGONOMICS: EVALUATING A NOVEL ARMREST TO REDUCE MUSCLE STRAIN

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ABSTRACT

Motorcycles are a primary mode of transportation in Malaysia, widely used for daily activities and work. The well-being of motorcyclists is crucial, especially regarding comfort during prolonged rides. This study evaluates the effectiveness of an armrest prototype in reducing muscle activity, measured by surface electromyography (sEMG), thereby alleviating discomfort. In two sessions (with and without the armrest), 102 participants rode a motorcycle for two hours using a laboratory riding simulator. The simulator projected a road scenery video, simulating daytime riding conditions. EMG signals were recorded to assess muscle activity in the right and left arms, with electrodes attached to the skin. The findings revealed a reduction in sEMG levels for both arms when using the armrest prototype for the flexor carpi radialis and flexor carpi ulnaris muscles. Furthermore, there was a significant difference in exertion muscles levels ($X^2(63) = 757.76, p < 0.001$) between the experimental group and the control group during the two-hour riding process. This study demonstrates that the armrest prototype can effectively reduce muscle activity and improve comfort for motorcyclists. By promoting better posture, this innovation could enhance rider safety and health, potentially reducing the risk of accidents.

Keywords: Armrest, muscle activity, motorcyclist, electromyography, experimental

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1.0 INTRODUCTION

Motorcycles are popular in Malaysia due to their simplicity and cost-effectiveness as a form of transportation. According to the Ministry of Transport Malaysia, motorcyclists and cars are the two most popular modes of transportation among Malaysians, with 718,416 motorcycles and 736,783 cars newly registered in 2022 [1]. Motorcycles are among the most popular two-wheeled vehicles in Southeast Asia. However, the riding posture has frequently been described as ergonomically inappropriate for humans. This is mainly because riders are usually sat in a static position with little support and no backrest [2]. Sitting discomfort on a motorcycle has become a key issue that must be addressed owing to limited space, constrained postures, extended riding hours, and the requirement to execute multiple tasks at once. These variables can contribute to muscular pain and musculoskeletal disorders (MSDs) [3].

The International Ergonomics Association [4] describes ergonomics as a scientific field concerned with developing and maximizing human well-being during interactions with product usage [5]. Ergonomics' fundamental purpose is to eliminate discomfort which can result in low work satisfaction, activity limits, and long-term disability [6]. In fact, ergonomics refers to the