

DETERIORATION WITH USE OF BOXING GLOVES ABSORPTION CHARACTERISTICS

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The numerous head injuries suffered in boxing (McCown, 1979; Ommaya et al., 1974, 1976; Unterharnscheidt, 1975) have raised many questions about the dynamic characteristics of the boxing gloves and their ability to prevent severe head trauma (Dessureault and Therrien, 1981; Johnson et al., 1975).

Problem

From 1945 to 1980, a total of 335 boxers have died in the ring (Moore, 1980), and in most cases, as a consequence of severe head trauma (McGown, 1979; Ommaya et al., 1976; Unterharnscheidt, 1975), even though all these boxers were wearing gloves which were supposed to cushion the different blows to functionally tolerable levels for humans.

The present research was undertaken in order to study under controlled conditions the shock cushioning characteristics of two categories of boxing gloves submitted to repetitive impacts. Another objective was to evaluate the changes taking place - if any - in the forces transmitted through the gloves after a series of impacts.

Method

In order to simulate a boxer's upper limb, with the hand covered with a boxing glove, hitting an opponent a double pendulum impact apparatus was set up and instrumented (see figure 1). It included the following components: 1) An aluminum manikin hand and forearm was fixed to a first pendulum, simulating the hitting arm of a boxer. The shape of the artificial hand permitted a realistic fitting of the gloves to be tested.

2) A mini-force platform was bolted to a second pendulum in order to measure the impact forces transmitted through the gloves.

3) A release mechanism was devised in such a way that it permitted the hitting pendulum to strike the receiving pendulum with a predetermined velocity which

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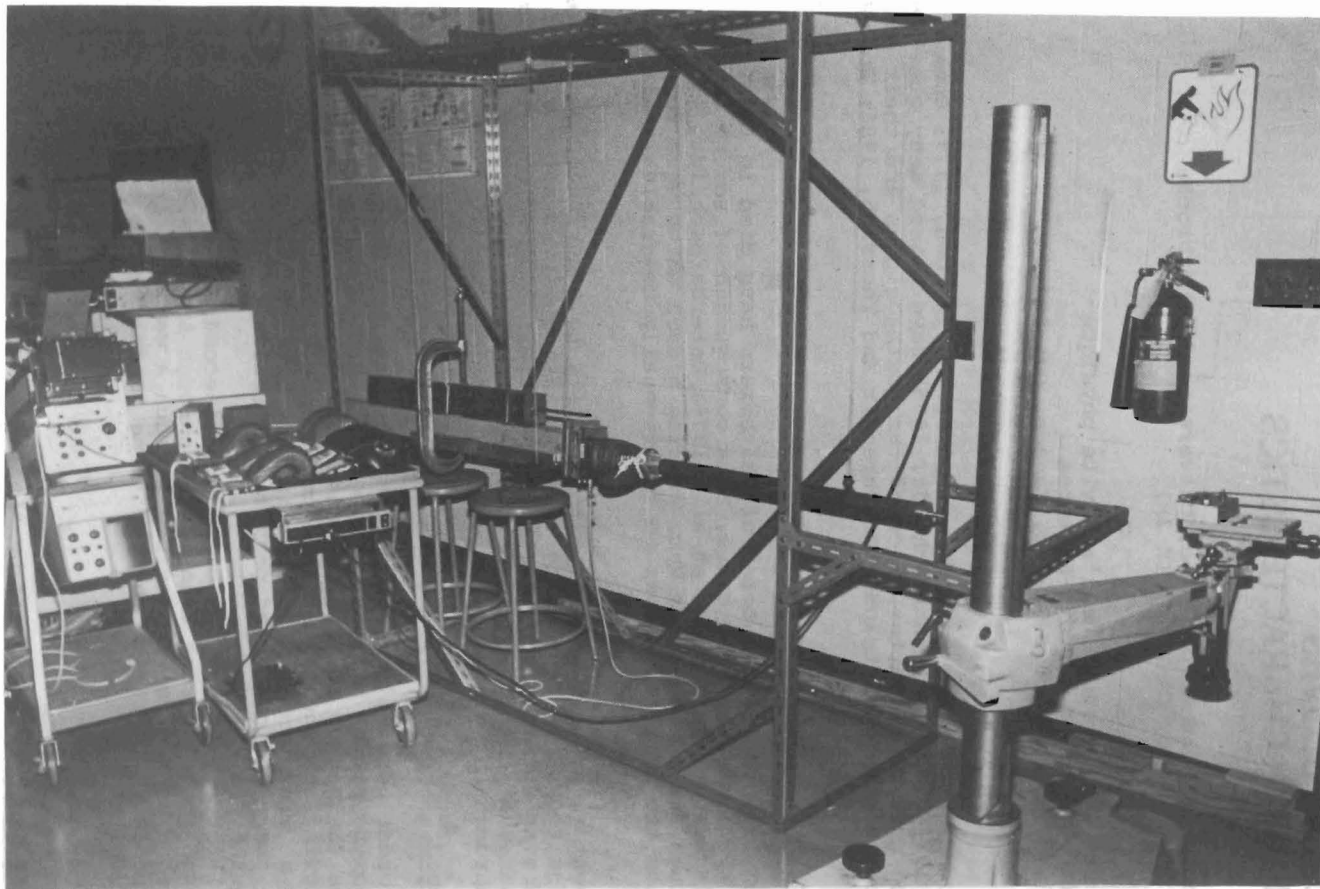


Figure 1. Overall view of experimental double pendulum impact apparatus.

was the same for each trial.

The weights of the pendulums and the height of release of the striking pendulum were set in such a way as to simulate the arm (3.65 kg) of a 61 kg boxer hitting an opponent of the same weight with a velocity of 8 ms^{-1} , thus producing a momentum of $29.2 \text{ kg}\cdot\text{ms}^{-1}$ at the point of impact.

The force transmitted through the glove at impact was measured through the force platform and recorded on a memory oscilloscope.

Each one of a total of eight (8) gloves, including two pairs of 8 ounces gloves and two pairs of 10 ounces gloves, was subjected to eleven consecutive impacts. The time period between each impact was 15 seconds except after impacts #1 and #6, in which cases the period was 60 seconds, in order that the oscilloscope tracing be photographically recorded.

Results

The evaluation of the force-time curves produced by the different impacts of the glove covered manikin hand on the pendulum supported force platform have shown a wide variation in the forces transmitted through the different gloves as well as from one trial to the other (See Figures 2 and 3).

The peak force registered on the first trial varied between 6100 and 11020 N for the 8 ounces gloves, and between 7400 N and 11900 N in the case of the 10 ounces gloves.

The maximum force transmitted through 8 ounces gloves was 7% to 54% higher on the eleventh impact than on the first one; in the case of the 10 ounces gloves, this increase ranged from 7% to 64%.

The results indicated a permanent decrease in the shock absorbing capacities of each glove after each impact, as indicated by the constant increase in the peak force transmitted through the gloves.

The results also indicated a wide variability in the impact absorption characteristics of the tested gloves, as well within each category, as between the two categories tested. Contrary to the popular belief, the heavier gloves did not exhibit any better cushioning capabilities than the lighter ones.

Conclusions

The analysis of the results obtained in the present study has indicated that all the boxing gloves used in this research exhibited a permanent deterioration in their shock absorption characteristics after each impact.

Moreover, the present categorisation of boxing gloves according to their weight does not reflect any relationship with their ability to cushion the different blows.

Finally, the unpredictability and the wide variability of the dynamic impact behavior of the gloves are considered unacceptable in a such a high

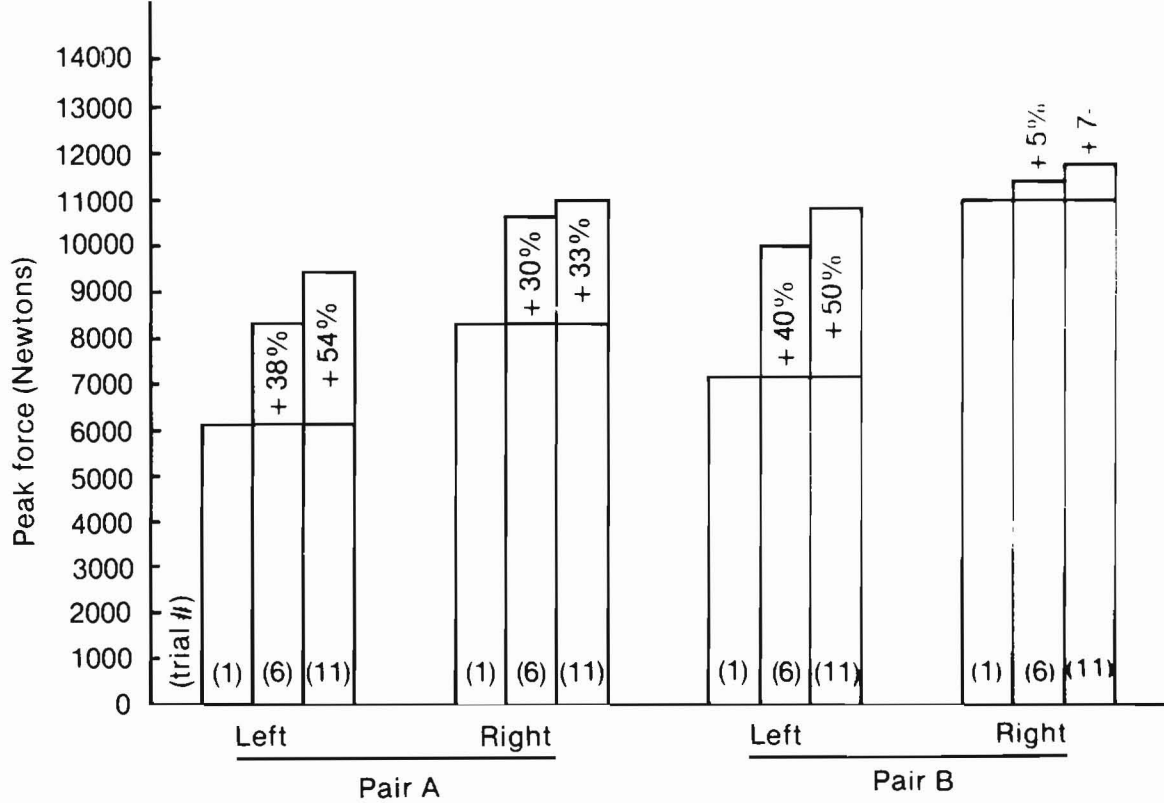


Figure 2. Forces transmitted through 8 ounces gloves.

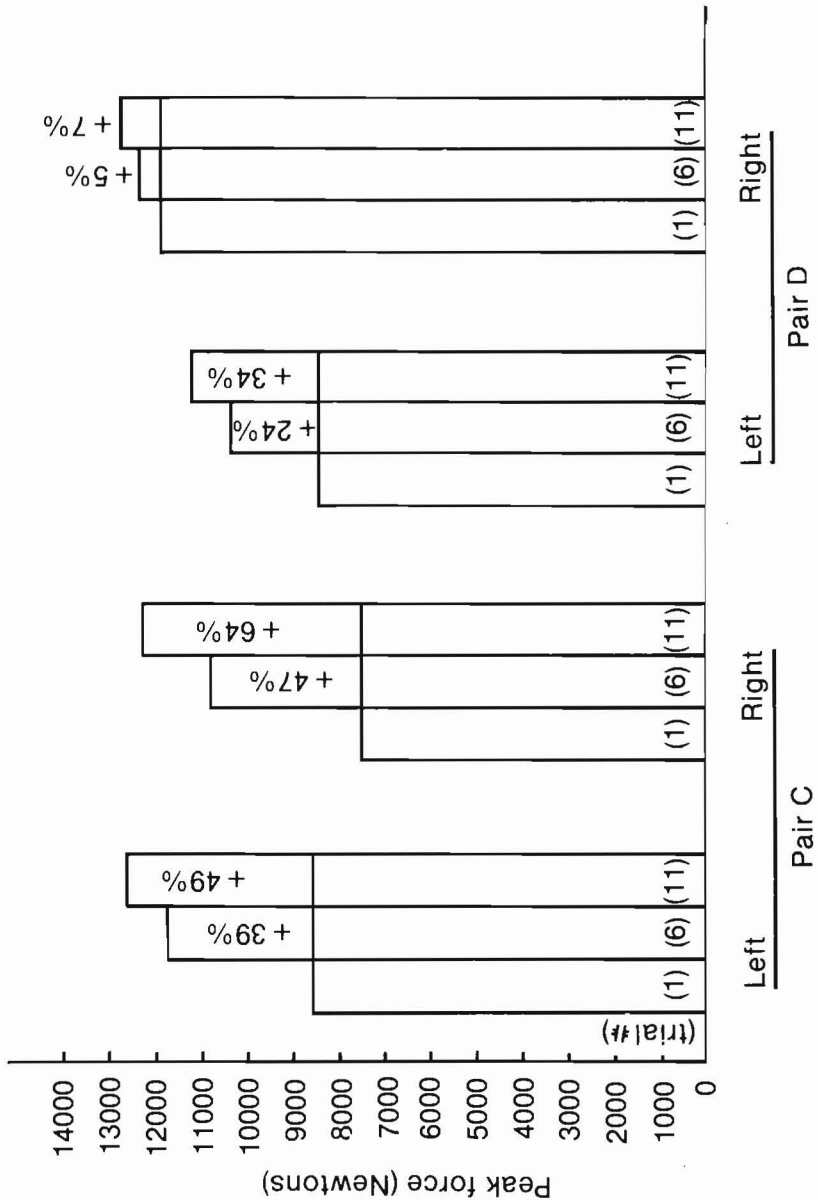


Figure 3. Forces transmitted through 10 ounces gloves.

risk activity as boxing.

This study has pointed out two major problems in boxing:

- 1) The important deterioration of the cushioning characteristics of the gloves with each impact, and
- 2) The inability of the gloves, after repetitive impacts, to efficiently decrease the risks of severe head trauma.

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