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THE EFFECTIVE LIFE OF CHAINSAW CHAPS
- A PILOT STUDY

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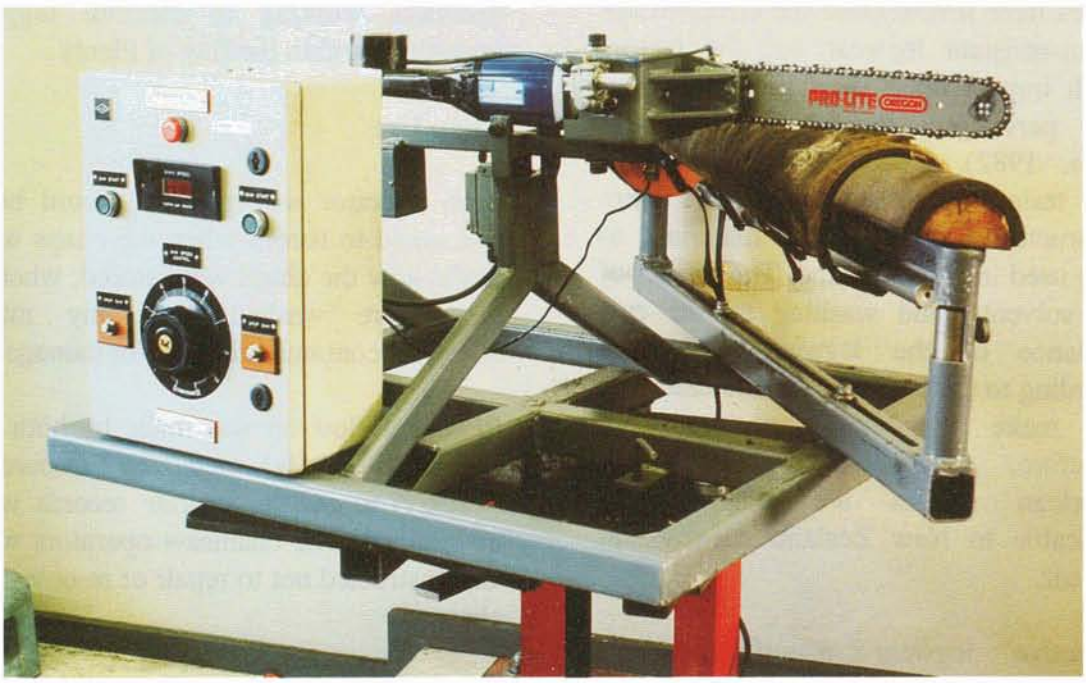

Figure 1 - New Zealand test rig

ABSTRACT

A pilot project attempted to determine whether the level of cut protection offered by chainsaw chaps was maintained after six months use in clearfell logging operations. The chaps were tested after three and six months use by full time chainsaw operators. After six months' continuous use, fifty percent of the sample had failed the New Zealand Standards test.

INTRODUCTION

Protective legwear became readily available in New Zealand in 1983. Gaskin (1986) credits this with a marked reduction in the proportion of reported leg injuries, which decreased from 29% in 1983 to 8% in 1986. Since this time, the proportion of chainsaw lacerations to the leg has fluctuated between 6% to 11% of all reported accidents.

One reason for the failure to eliminate chainsaw lacerations to the leg is that current protective legwear is *cut-resistant*, not *cut-proof*. Protective legwear is designed to resist chainspeeds of up to 20 metres a second (m/sec) but many chainsaws can produce chainspeeds that exceed this level. Additionally, the effectiveness of the legwear may deteriorate with age, cuts, nicks and exposure to solvents. The lack of research to quantify the latter has resulted in an absence of firm replacement guidelines. Consequently, there is a widely held belief that the chaps will last at least 12 months.

A small number of North American studies have investigated the effective life of cut-resistant legwear and the factors which impact upon their life (Knezevic, 1993 pers com; Putnam, Jackson and Davis, 1982). However, the protective pads tested in these two studies were constructed from different materials to those used in New Zealand. The impact of age, solvents, and washing on the cut-resistance of the legwear will vary according to the properties of the materials that make up the protective pad. Therefore, results from the North American studies are not directly applicable to New Zealand cut-resistant legwear.

Protective legwear manufactured in Sweden uses protective pads similar to those used in New Zealand. Swedish research has found that washing detergent reduced the level of protection offered by the legwear (Milling, 1996 pers com.). There has been no research on the impact of washing detergent on the level of protection offered by New Zealand manufactured protective legwear.

The present study investigated the effective life of New Zealand manufactured chaps and the factors which impact upon their life.

ACKNOWLEDGMENTS

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METHOD

Subjects

The subjects were 12 full time chainsaw operators working in clearfell logging operations within the Bay of Plenty.

Chap Use

Each operator was given a record book and asked to record when the chaps were worn, how the chaps were stored, whether they were washed, and any major oil/petrol contamination and/or damage.

Regular follow-up was made by both the contractor (daily) and the researcher (weekly) to ensure accurate records were maintained. The chainsaw operators were also instructed not to repair or re-cover the chaps.

Testing Protocol

Eighteen pairs of "S-marked" chaps, which had been manufactured in accordance with the New Zealand Standard, NZS 5840:1988 Amendment 1 (NZS5840), were purchased directly from the manufacturers. Six of the chaps were immediately sent to Imtest Laboratories for destructive cut testing. The other twelve pairs were distributed to the operators.

As the New Zealand Standard requires six pairs of chaps for a full Standards test, it was planned to destructively cut test six

pairs of chaps after three months' use and six pairs after six months' use.

In order to determine how long the chaps offered the level of protection required by the New Zealand Standard, the left leg was tested in accordance with NZS5840.

Test Procedure : NZS5840

The left leg was used for destructive cut-testing to the New Zealand Standard, as anecdotal evidence suggests this leg is subjected to more oil/petrol spills and wear. The left leg of the chaps was buckled to the leg of the test rig (Figure 1). A bar exerting a force of 50 Newton/metres was placed on the chap's buckled straps to hold the chap tight against the test rig. The bar of the electric test saw was set 1mm above and at 45° to the chap leg, then the chain was accelerated to 20 m/sec. At the same instant as the saw was released on to the chap leg, the power supply to the electric motor was cut off.

Each leg was cut once, with three of the six pairs being cut at 50cm from the top of the waistband and three at 80cm. A pass was achieved if the test rig foam pad, positioned under the chap, was unmarked by the chainsaw upon the completion of all six tests.

RESULTS

Table 1 contains information on chap condition and use obtained from the operator's record book. The comments were derived from a pre-test inspection by the researcher, and important comments by the operator. There are several notable features shown in Table 1. Most loggers store their chaps in the work van or at home. Only one of the samples was stored on the ground in the forest.

Almost all the chaps (80%) had small nicks or cuts, but only two of these (samples 7 and 8) resulted in visible damage to the protective pad. The outer materials of all samples had a coating of mud, petrol and oil, with samples 7, 8, 10, 12 and 13 being saturated in oil and/or mud. Sample 16 was the only pair to be

Table 1 - Chap condition and use

Sample	Task	Storage	Washes	Nicks/Cuts	Comments
7	Fell	work van	4 warm	large rip in left outer, small holes in right	Soaked with oil/petrol, pad slightly damaged
8	Fell some skidwork	work van	none	lower left small tear	Very muddy, pad hanging out tear in outer
9	Felling	work van	1 warm	little nick in left outer and three on right leg	Pad appeared undamaged
10	Fell some machine op	porch	1 warm, 1 cold	none	Very oily, pad undamaged
11	Felling	home	none	small nick low left	Pad undamaged
12	Felling	work van	1 cold	small nick on left leg	Very oily and muddy, pad undamaged
13	Fell and skidwork	work van	1 warm 4 cold	small nick mid-right leg	Very oily and muddy, pad undamaged
14	Skidwork some fell	work van	2 cold 1 warm	small nicks left and right lower	Pad undamaged
15	Fell some machine op	work van	none	none	Pad undamaged
16	Fell some machine op	bush and van	19 cold	small nick left lower	Chaps had been soaked in diesel, pad undamaged

accidentally soaked in diesel. Only one pair of chaps (sample 16) was washed regularly, three pairs were never washed (samples 8, 11, 15) and the remainder were washed infrequently. Two pairs of chaps designated for testing at three months were stolen, hence information on these chaps are not included in the results.

Table 2 contains a summary of the results of testing the left leg to NZS5840. All six pairs of the new chaps passed the test. After three months, three of the four remaining chaps passed, while the fourth failed. The removal of the buckles from one of the samples is thought to have contributed to this failure. The alternative method of securing the chaps to the test rig prevented the chaps twisting and distributing the force over more of the protective material. After six months of use in production logging operations, three of the six pairs of chaps failed.

Figure 2 shows that the mean weight of both chap legs increased with increasing use. This was due to the retention of oil, petrol, earth, and water by the legwear. Although statistically insignificant ($P < 0.05$), the left leg increased both at a higher rate, and to a higher level than the right leg.

Table 2 - New Zealand Standards test (left leg)

Samples	Time in Use (Months)	Mean Weight grams(± SD)	Chain Speed (m/sec)	Percentage Pass
1-6	0	642.2 (± 6.6)	20	100%
7-10	3	804.5 (± 51.0)	20	75%
11-16	6	833.7 (± 44.3)	20	50%

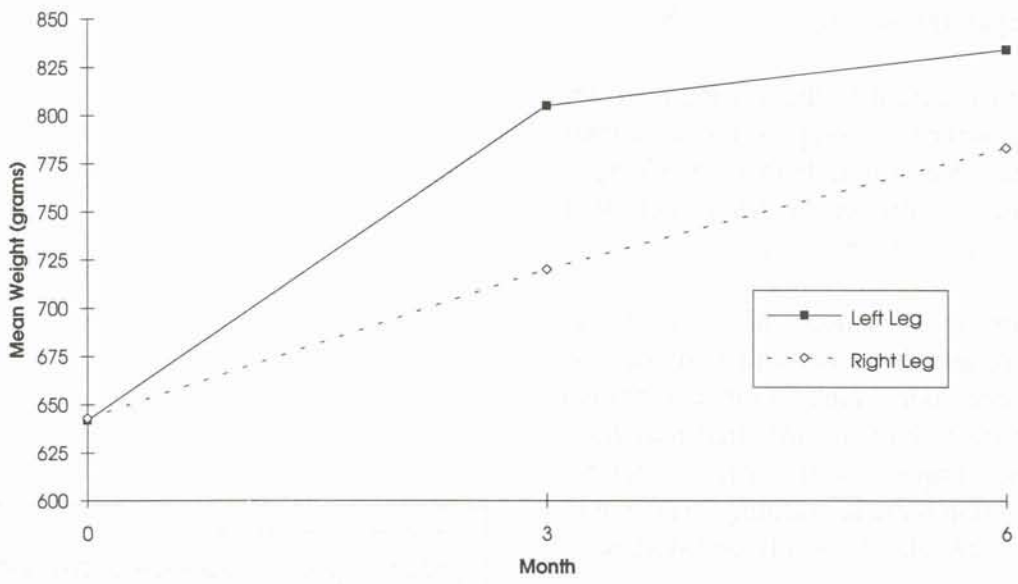

Figure 2 - Change in mean chap leg weight

DISCUSSION

All six pairs of the new chaps passed the cut-test, thereby passing the New Zealand Standard. After three months' use in clearfell logging conditions, the full NZS5840 test could not be performed as there were only four samples left. However, three of these passed.

After six months' use in production logging conditions, three of the remaining six chaps failed the NZS5840 test. Only one of the six chaps needs to fail for the chaps to be considered below the Standard.

The presence of nicks/cuts does not appear to have affected the result of the test at three or six months. Even when the protective pads were visibly damaged, the leg still passed NZS5840.

In line with Swedish findings (Milling, 1996 pers com.), washing appears to have affected the result of the test. Two of the three legs that passed at six months had never been washed, while all three pairs that failed had been washed at least once. However, due to the small sample size and the large number of confounding variables, no firm conclusions can be made regarding the impact of washing.

The higher weight of the left leg provides some evidence to support the anecdotal evidence which suggests that the left leg is subjected to a greater amount of petrol/oil contamination, but not wear.

The number of samples tested here was too small and the number of variables too high to conclude which factors contributed to garment failure. Factors that may have had an impact and require further investigation include washing, exposure to solvents (petrol, oil, diesel), and storage.

While it is acknowledged that this pilot study had a small sample size, it is alarming to note the high failure rate after only six months use.

CONCLUSIONS

After six months continuous use fifty percent of the sample had failed the New Zealand Standards test.

Further research with a larger sample size needs to be undertaken to confirm this result and more accurately define chap replacement time.

Further research is also necessary into the factors affecting chap life, specifically chap storage, exposure to solvents and washing.

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