SELF EQUALISING ANCHORS : a MYTH?

A comparison of the load-distributing properties of symmetrical 2-limb self-equalising and non-self-equalising rope rescue anchor systems.

by R.Owen & S. Naguran

Abstract

This study aimed to compare the load distributing properties of two-limb self-equalising and non-self-equalising anchor systems. A paired t-test (n=23) was used to compare the mean difference in load between the limbs of a self-equalising anchor system with that of a non-self equalising anchor system when a test load of 100kg was applied to the anchor system. The results showed that the self-equalising anchor system (mean difference between loads = 12.61kg) distributed the load to its component anchors significantly less equitably ($p<0.01$) than the non-self-equalising anchor system (mean difference between loads = 6.43kg).

Introduction

There has been some controversy over the use of self-equalising anchor systems in rope rescue. Some authors have described the self-equalising anchor system as an option for rope rescue, although the indications for this system over others have not been clearly stated [1]. Some authors have described the self-equalising anchor system as potentially dangerous, but a possible last resort in an attempt to construct a single strong anchor from a series of marginal ones [2]. Others have argued against equalising anchors generally, believing these to be intrinsically unsafe and their perceived ability to distribute loads overstated. They argue in favour of rescue systems based on single anchors with a secondary anchor of similar proportions providing redundancy in the event of primary anchor failure [3].

Aim

The aim of this study was to compare self-equalising and non-self-equalising anchor systems in terms of their ability to distribute loads between their component anchors by disproving the null hypothesis that the mean of the absolute difference between the limbs of the self-equalising anchor system equalled that of the non-self-equalising anchor system.

Methodology

Each participant in the study (n=23) constructed both a 2-limb self-equalising (see Fig. 1) and a 2-limb non-self-equalising anchor system (see Fig. 2) using two bolts placed 50cm apart and at right angles to the direction of the test load applied to the system (thus ensuring anchor system symmetry). The order in which these were tied was randomised. A test load of 100kg was applied to the anchor system (see Fig. 3) and the load in each limb measured using a digital load-cell calibrated to the nearest kilogram (see Fig. 4). The absolute difference between the loads in each limb was recorded for each participant for each anchor system (calculating the square root of the difference squared derived the absolute difference).

Data Analysis

The data's distribution was confirmed as normal (thus meeting the assumptions for parametric statistics) through the use of descriptive statistics and plots (stem-and-leaf, box plot and normal and detrended Q-Q plots) and the Kolmogarov-Smirnov (with Lillifors Significance Correction) and the Shapiro-Wilk tests for normality. The means of the absolute difference between limb loads were compared using the paired t-test with the level (a) set at 0.05 for rejection of the null hypothesis. The analysis was conducted using SPSS 11.0 for Windows.

Results

There was a highly significant ($p<0.01$) difference between the means of the absolute difference between the limbs of the non-self-equalising anchor systems (mean = 6.43kg; 95% CI 4.07-8.80kg) and those of the self-equalising anchor point systems (mean = 12.61kg; 95% CI 9.03-16.19kg). This indicates that the non-self-equalising anchor system resulted in more equitable distribution of the load than the self-equalising anchor system.

Limitations of the study

This study compared two anchor systems under very specific conditions. These included: a symmetrical anchor system design, a single test load and controlled anchor system loading. Furthermore, the study was restricted to 2-limb anchor systems rigged in a very particular manner. The results of the study may only be valid under similar conditions. Future studies should investigate the validity of these results in terms of the use of these anchor systems with asymmetrical component anchors, under various test loads applied both statically and dynamically and using different approaches to rigging these classes of anchor system.

Conclusion

Under the test conditions, a non-self equalising anchor system distributes the load more equitably between its component anchors than a self-equalising anchor system. Although further study is required, the results appear to support the argument for discontinuing the use of self-equalising anchor systems in favour of non-self equalising anchor systems in rope rescue practice.

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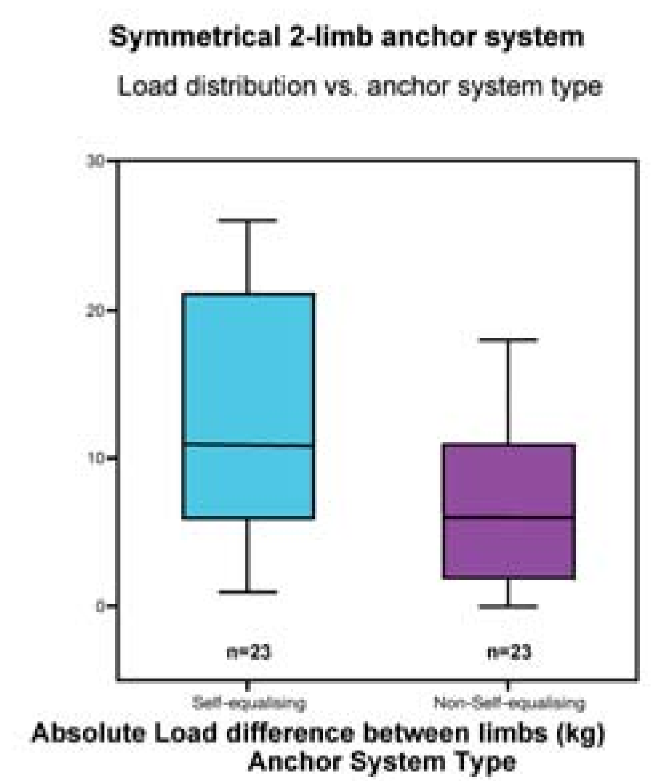

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Reference List

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2.Vines T, Hudson T. High Angle Rescue Techniques. St. Louis: Mosby, 1999.
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