Original Contribution

Evaluating the Cost-effectiveness of Various Widths of Synthetic Casting Tapes: Is Bigger Better?

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Background

Four primary widths of synthetic casting tapes are available to the orthopedic practitioner for use in constructing casts. These tapes range in width from 2-inch to 5-inch, and have a standardized running length of 4-yards. Casts produced with these tapes are strong, light, water resistant, and allow early weight bearing and are, therefore, very attractive for both patient and practitioner (1-5). However, the indiscriminate use of these tapes can add considerably to a clinic's budget (6).

To date, little information has been available that addresses the cost-effectiveness of the various tape widths and their potential use in the clinical setting. The purpose of this paper is to evaluate the cost-effectiveness of the four primary widths of casting tape by developing and comparing an accurate cost and strength analysis of each.

Cost Analysis

To determine comparison costs of casting tape by width, an average price per roll of casting tape was determined from list prices posted on-line by several medical supply companies. In addition, the number of square inches of casting tape per roll was also calculated. A cost per square inch was then determined for each width of tape. The results are shown in Table 1.

The table illustrates that the cost per roll increases as the tape gets wider, suggesting that the most cost-effective tapes are the smaller ones. However, in actuality, as the width of the roll increases in size, the cost per square inch of tape drops. This is due to manufacturing, packaging, and shipping costs associated with the production and distribution of the tape. The wider the tape roll, the less cutting, packaging, and handling that is required for manufacture and distribution.

To further illustrate the cost savings inherent with the use of wider rolls of tape, consider the need to apply a short leg cast to an adult patient. If four rolls of 3-inch tape were used, the total cost of the four rolls would be $20.80. However, if 3 rolls of 4-inch were used, the cost for the three rolls would be $19.20, a saving of $1.60. In both cases, the total amount of casting tape used was 1200 square inches, making the wider tape the more cost-effective choice. If two rolls of 5-inch were used with a total amount of 1440 square inches, the total tape costs would drop to $15.60 - a savings, of $5.20 or 25 percent.

While the savings demonstrated in this example are not singularly significant, compounding them in a clinical setting that averages 20 casts a day over a year could generate close to $30,000 in savings.

Effective Strength

To determine the effective strength of the casting tape by width, four equal sized cast-like cylinders were constructed; each made with a different width of tape. The tape manufacturer's instructions for use and application procedures were followed in an effort to replicate the typical clinical casting process.

The tape was wrapped spirally around a 3-inch diameter cardboard tube within a 12-inch area, overlapping the previous turn one half to two thirds the width of the tape. A total of 720-square inches of tape were applied for each cylinder.

The hardened tape cylinder was then removed from the cardboard tube and cut down to a 6-inch length by removing 3-inches from each end. This was done to assure that equal thickness of tape was used for the strength test. A thickness of four layers of tape was

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present in all four of the cylinder samples. The thickness variation between the four cylinders was .023-inches.

The four cylinders were then subjected to compression or crush testing using an Instron materials testing system to determine the strength of each cylinder. A series of increasing loads in foot-pounds was applied to each cylinder until they developed cracks, collapsed, and failed. The results of the test are shown in Table 2.

A review of the results reveals that as cylinders were constructed with wider casting tapes, the maximum break load increased. For example, the cylinder constructed with 1 roll of 5-inch tape required 136 more pounds of force to cause it to fail than the equal-sized cylinder constructed from 2-inch tape, an increase in performance of 25 percent. Although the increase drops to 15 percent when the break load of the 2-inch tape is compared to both the 3 and 4-inch tapes, the 75-pound increase needed to break the 3 and 4-inch tapes is still significant.

Other Benefits

In addition to the lower cost and greater strength benefits of wider casting tape, there are other benefits associated with the use of these tapes.

First, application time is reduced, as less time is spent opening, dipping, and applying the wider tape rolls. For example, a short leg cast for an adult patient could be constructed using 4 rolls of 3-inch tape, a total of 1200 square inches of tape. Conversely, 3 rolls of 4-inch tape could also be used, again providing 1200 square inches of tape. However, by using the wider tape rolls, the time needed to open, dip, and apply an additional roll of tape is eliminated. While this may represent only a small time saving of a few minutes, these timesavings could become significant when spread over a busy clinical day of continuous casting.

Second, wider tapes produce stronger casts using less rolls of tape and with less waste. As noted in Table 2, a single roll of 5-inch tape produced a cylinder cast that was stronger than 1.2 rolls of 4-inch tape, 1.6 rolls of 3-inch tape, and 2.5 rolls of 2-inch tape.

Third, by using wider, stronger tapes, premature patient returns for repair and reapplication is reduced. These returns are neither convenient nor cost-effective for the patient or the practitioner, as they not only place an additional burden on the cast room, but also add to the workload in appointments, record keeping, and transcriptions.

Finally, clinical storage needs are reduced, as the space needed to store one box of 4 or 5-inch tape is significantly less than that needed to store the equivalent 2.5 boxes of 2-inch tape. While there is no doubt that a variety of tape widths will be needed to meet clinical casting needs, it is more cost-effective to stock and store wider tape widths.

Conclusion

Progressive orthopedic technicians and clinical managers can benefit from the use of wider tape widths in

TABLE 1. Casting tape costs by width

tape width/ length	area per roll	cost per roll	cost per square inch
2-inch x 4 yards	288-square inches	$4.10	$ .0142
3-inch x 4 yards	432-square inches	$5.20	$ .0120
4-inch x 4 yards	576-square inches	$6.40	$ .0111
5-inch x 4 yards	720-square inches	$7.80	$ .0108

TABLE 2. Maximum breaking loads of casting tape cylinders

tape width	rolls used	tape per cylinder	maximum break load
2-inch	2.5	720-square inches	403.50-foot-pounds
3-inch	1.6	720-square inches	476.00-foot-pounds
4-inch	1.2	720-square inches	477.60-foot-pounds
5-inch	1	720-square inches	539.60-foot-pounds

their clinical settings. Wider tapes are stronger, less costly, and can contribute to improving clinical cost-effectiveness. Bigger is better!

ABOUT THE AUTHORS

Steven Cutler is a certified orthopedic technician who is employed by Orthopedic Associates of Lancaster, PA. He has 22 years experience in the application of casting materials and is a member of NAOT and secretary of PAOT, the Pennsylvania Association of Orthopedic Technicians. He is also the president of Cast Cutler, a business dedicated to teaching the "Art of Casting".

David Witmer is employed at the Pennsylvania State University and has been involved in both private and public health and safety research initiatives. He holds both bachelor of arts and master of science degrees in industrial design and educational systems. During the past few years, he has been investigating the strength and durability of synthetic casting materials. The author has been a NAOT member for several years.

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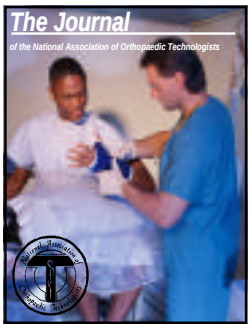

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