SIU Southern Illinois University
CARBONDALE

BIOPSY RETRIEVAL METHODS

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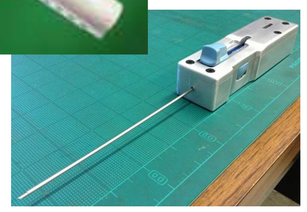
Abstract

A core biopsy is used to retrieve a sample of tissue to be analyzed for abnormalities. This project focuses on the needles used in this process. The objective of this research is to explain how biopsy needles work, compare different types of biopsy needles, and evaluate the effectiveness of different designs. The comparison will allow us to see if the prototypal needle could adequately replace the commercial needles.

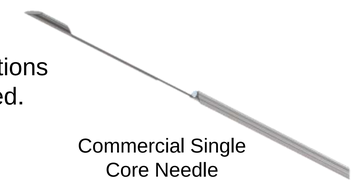
The current commercial needles, which take one sample, will be compared to multiple dual core biopsy needle prototypes, meaning that they have two grooves, each of which will retrieve one sample from the biopsied region. This project shows the differences in damage to the biopsy needle when a soft metal and a hard metal are used. As the needle must be sharp and accurate when taking a biopsy sample, the metal used in the needle must be strong enough to withstand the stress of testing. The needles were tested using substances such as banana and apple which may mimic the density of real organs. The samples are measured by the amount retrieved with each biopsy, and compared to the other tests done on the same substance.

After taking each biopsy, the samples will be removed using another smaller gauge needle which can fit inside the groove of the biopsy needle. During an actual biopsy, the sample would then be placed in a secure container and sent to a pathologist for analysis.



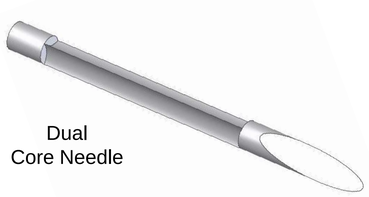
Biopsy Needles

The current commercial biopsy needles have a single groove and are surrounded by a close- fitting sheath. The sheath functions to cut the tissue of the organ being biopsied.

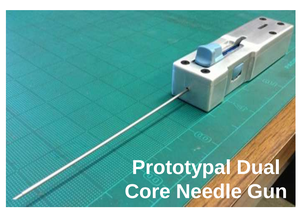


Commercial Single Core Needle

A dual core needle has a similar design, but whereas a commercial needle has only one groove, these prototypes have two grooves, therefore allowing two samples to be taken from the same region.



Dual Core Needle

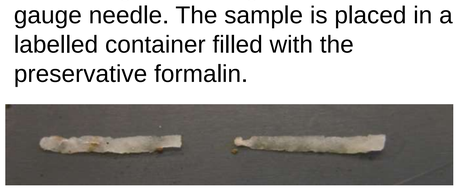


Prototypal Dual Core Needle Gun

Retrieval Method

Once the needle is in the firing position and fired, it leaves the sheath and penetrates the legion. The tissue will then fill the groove, or grooves. The cutting sheath then moves over the needle once more, cutting the tissue and securing the sample within the groove of the needle.

The sample can then be removed From the groove using another, smaller gauge needle. The sample is placed in a labelled container filled with the preservative formalin.



Example of Biopsy Sample Tissue

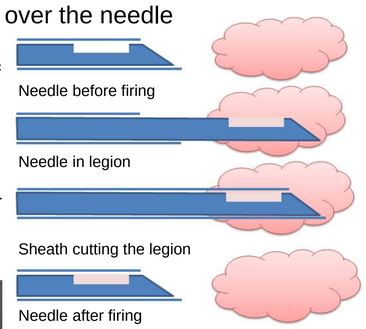


Illustration of the retrieval process

Discussion and Conclusions

The results show that dual core needle was much less successful at retrieving samples, though the commercial needle lacks the capability to collect multiple samples simultaneously. The amount of core sample retrieved was substantially less with each substance than its commercial needle counterpart. The banana yielded the best results for both needles, producing full or nearly full samples each time.

With the dual core needle, the right core retrieved much smaller samples than the left core in nearly every trial. One possible reason for this inconsistency could be due to the design of the needle. If it were to bend when taking the sample, that could explain why the right side nearly always yielded much smaller samples.

It was also observed that while the banana yielded the largest, most complete samples, the chicken breast samples were the smallest. This holds true for both the single and dual core needles. Because this was seen in both types of needles, it would seem that the reason for the smaller samples is due more to the substance than the type of needle.

The largest variant for a given substance with the single core needle is a difference of 20% of a core sample, while the largest difference in a single side of the dual core needle for a given substance is a difference of 70% of a core sample (as seen in the left cores of apples). This increased inconsistency of the dual core needle further shows why the commercial needle proved superior in these trials.

When comparing the hard metal sheath to the softer metal sheath, it is clear that the durability of the hard metal sheath is superior to its soft metal counterpart. When looking at the crimping at the tips of each, the soft metal sheath shows a greater degree of damage.

This damage will inhibit good samples to be retrieved as a sharp edge is necessary for the cutting of the tissue. In addition, the damage seen here could cause resistance as the sheath slides along the needle, further inhibiting the successful retrieval of full core samples. While the hard metal sheath also procured some damage which could alter its performance, it is clear that of the two, it is the better option.

Results

The test results shown are for the comparison of a commercial single core needle and a prototypal dual core needle on banana, apple, and raw chicken breast samples. Each needle underwent five trials for each substance. The approximate percentage of the groove that the sample filled is given.

Commercial Single Core Needle

Trial	Banana	Apple	Chicken
1	100%	75%	30%
2	100%	80%	40%
3	80%	70%	50%
4	90%	75%	30%
5	100%	70%	40%

First Dual Core Prototypal Needle

Banana

Trial	Left Core	Right Core
1	90%	60%
2	90%	5%
3	100%	10%
4	100%	60%
5	100%	35%

Apple

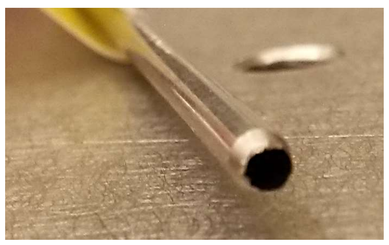
Trial	Left Core	Right Core
1	30%	25%
2	75%	5%
3	100%	5%
4	40%	50%
5	80%	0%

Chicken Breast

Trial	Left Core	Right Core
1	10%	30%
2	15%	0%
3	15%	10%
4	10%	5%
5	10%	2%

Two different sheaths were placed around dual core needles. One was made of a thick, harder metal, and one of a thin, softer metal. After taking the biopsies of these substances, the damage was recorded for comparison of durability. Both were damaged, though the extent of the damage found on the soft sheath was to a greater degree.

Soft metal sheath after biopsies



Hard metal sheath after biopsies

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