



Ultrasound-enhanced fine-needle aspiration biopsy

Improves yield in ex vivo human thyroid tissue

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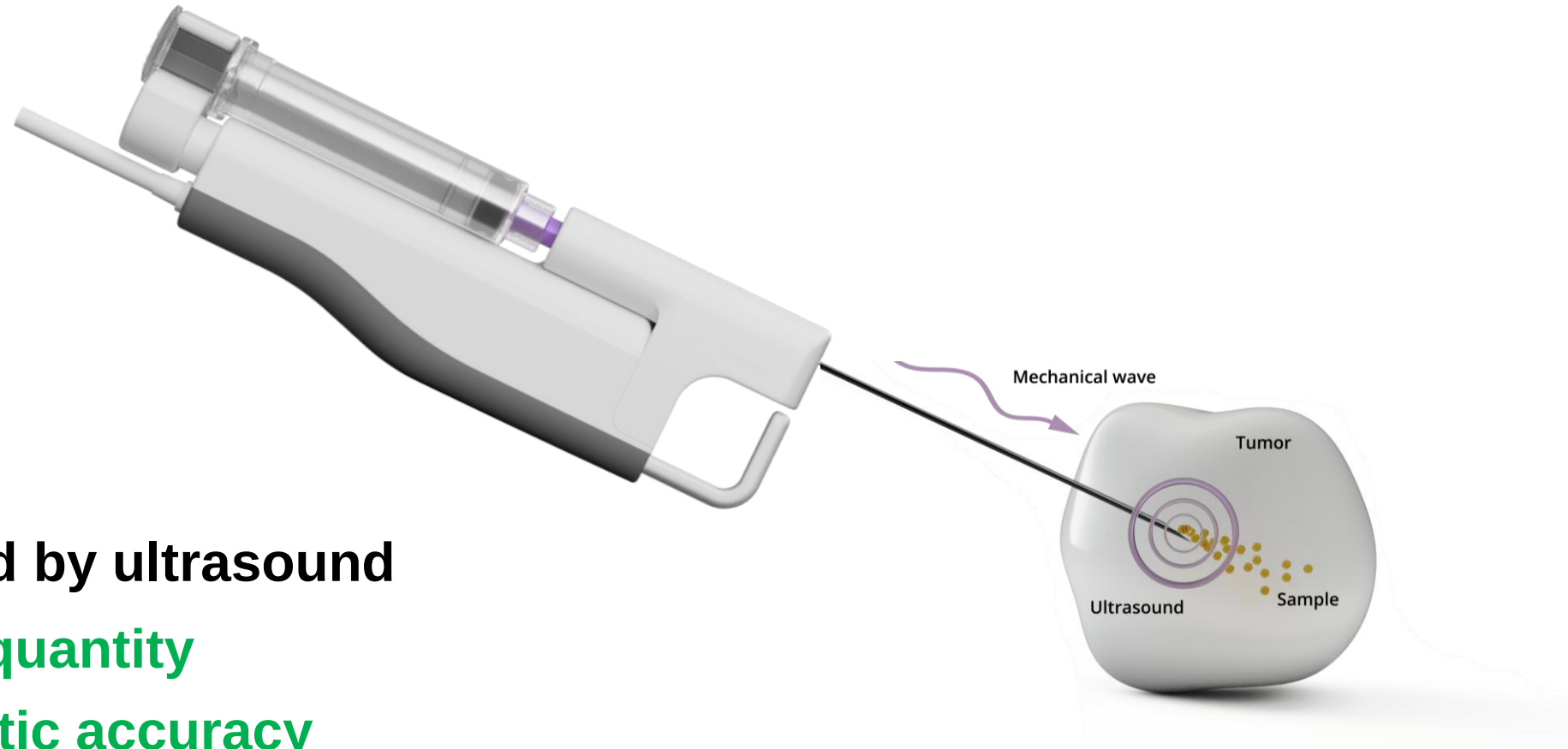
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Concept: Ultrasound-enhanced fine needle aspiration biopsy (USeFNAB)

- Small needle size
- Needle tip actuated by ultrasound
- Improved sample quantity
- Increased diagnostic accuracy
- Low risk for trauma

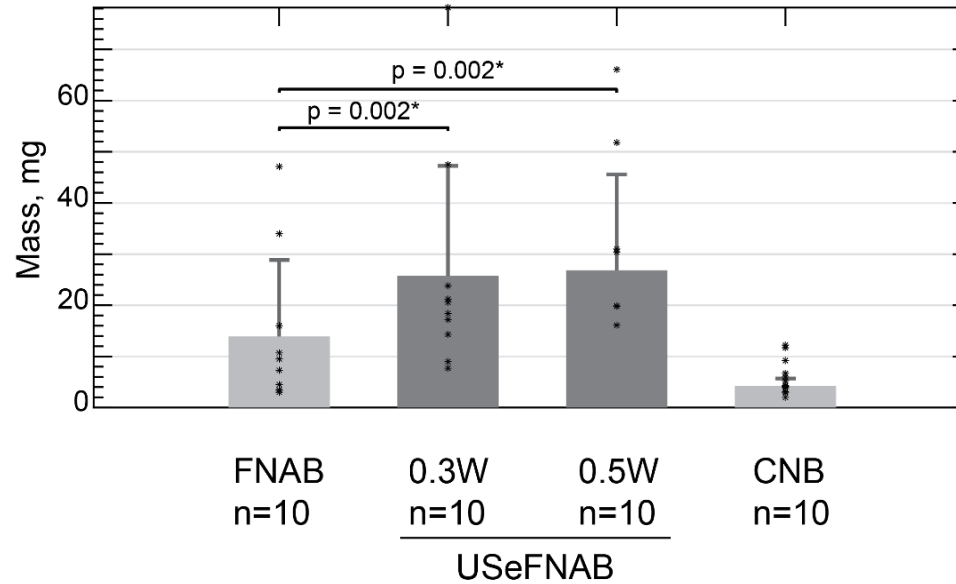
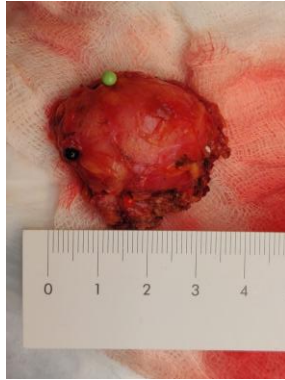


Background



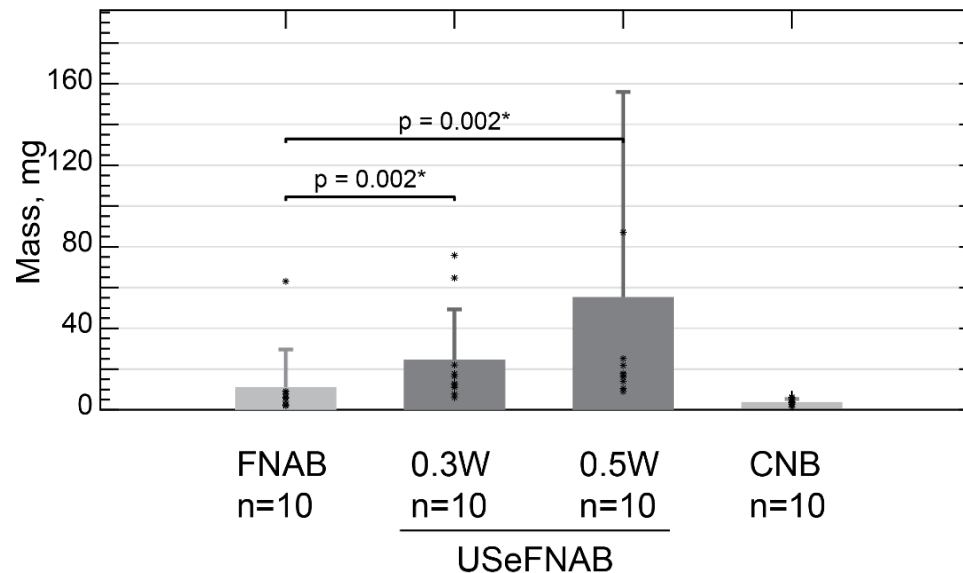
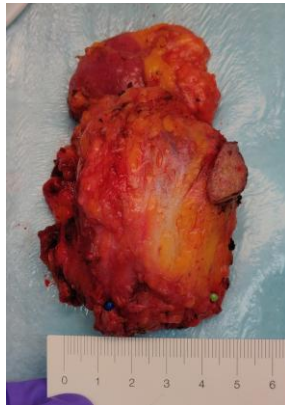
USeFNAB: human *ex vivo*, head and neck tumors

Tumor
Salivary
gland
adenomas



In salivary gland adenomas, the tissue yield increased by **1.9x** and **7.0x** compared to FNAB and CNB, respectively.

Cancer
Head and neck
cancers

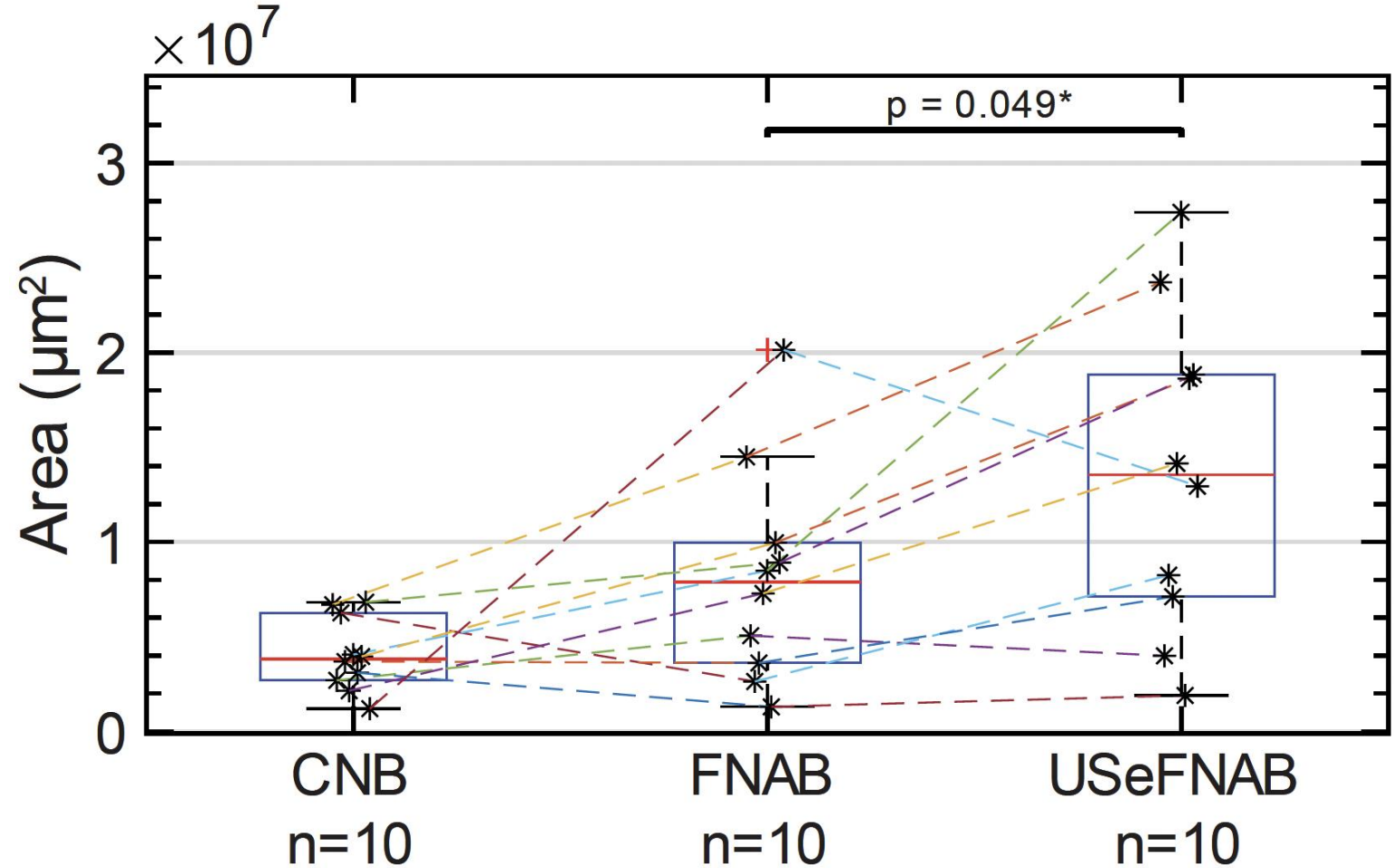


In the head and neck cancers, the tissue yield increased by **4.6x** and **14.4x** compared to FNAB and CNB, respectively.



In vivo human Salivary adenoma, yield from microscopy (tissue area)

- Yield increase in USeFNAB by 1.7x or 3.4x as compared to FNAB or CNB, respectively.
- Sample quality in USeFNAB comparable to FNAB or CNB.



Aim

**To demonstrate the performance of USeFNAB
on *ex vivo* human thyroid cancer**

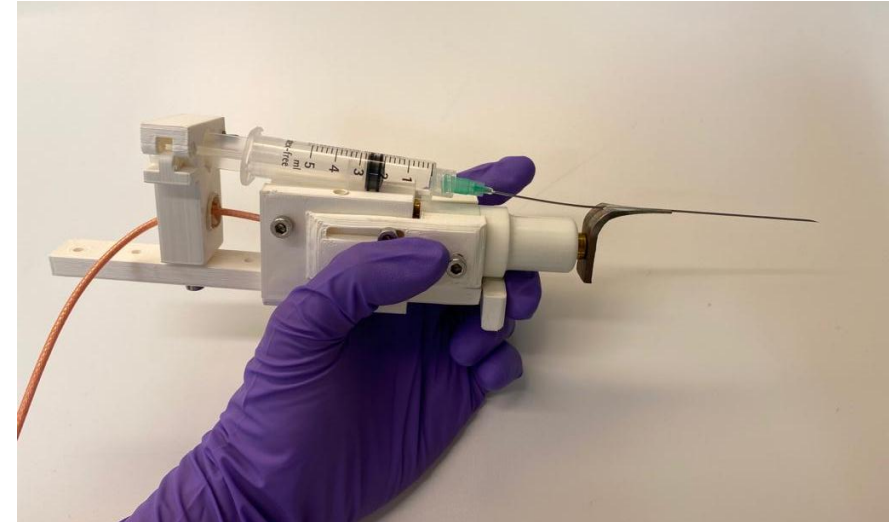


Material and methods

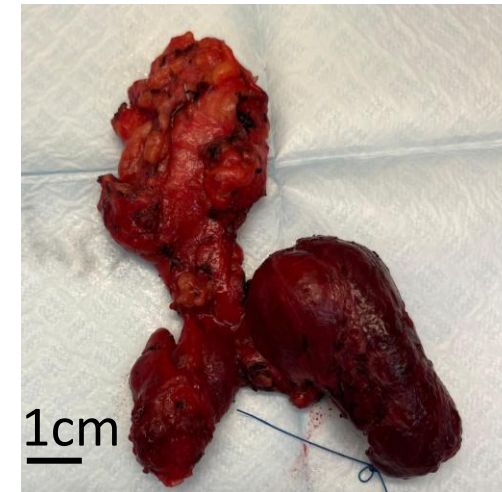


Material and methods

- **Post calibration frequency:** 28-32 kHz
 - **Ultrasound sequence:**
 - Burst signal:
 - 300 cycles / burst; burst period=18 ms (duty cycle=50%)
 - Averaged consumed power: 0.5 W
 - Biopsy time: 10s
 - **Tissue: *ex vivo* thyroid**
 - Surgical excision < 5h
 - Size: > 2 cm Ø
 - N = 10
 - Ethical approval: 241/2021, patient consent obtained
 - **Biopsy groups:**
 - CNB (n = 10)
 - FNAB (n = 10)
 - USeFNAB (n=10)
-
- **Analysis**
 - Weight
 - Tissue area on histological slide



Low pressure gun coupled with USeFNAB



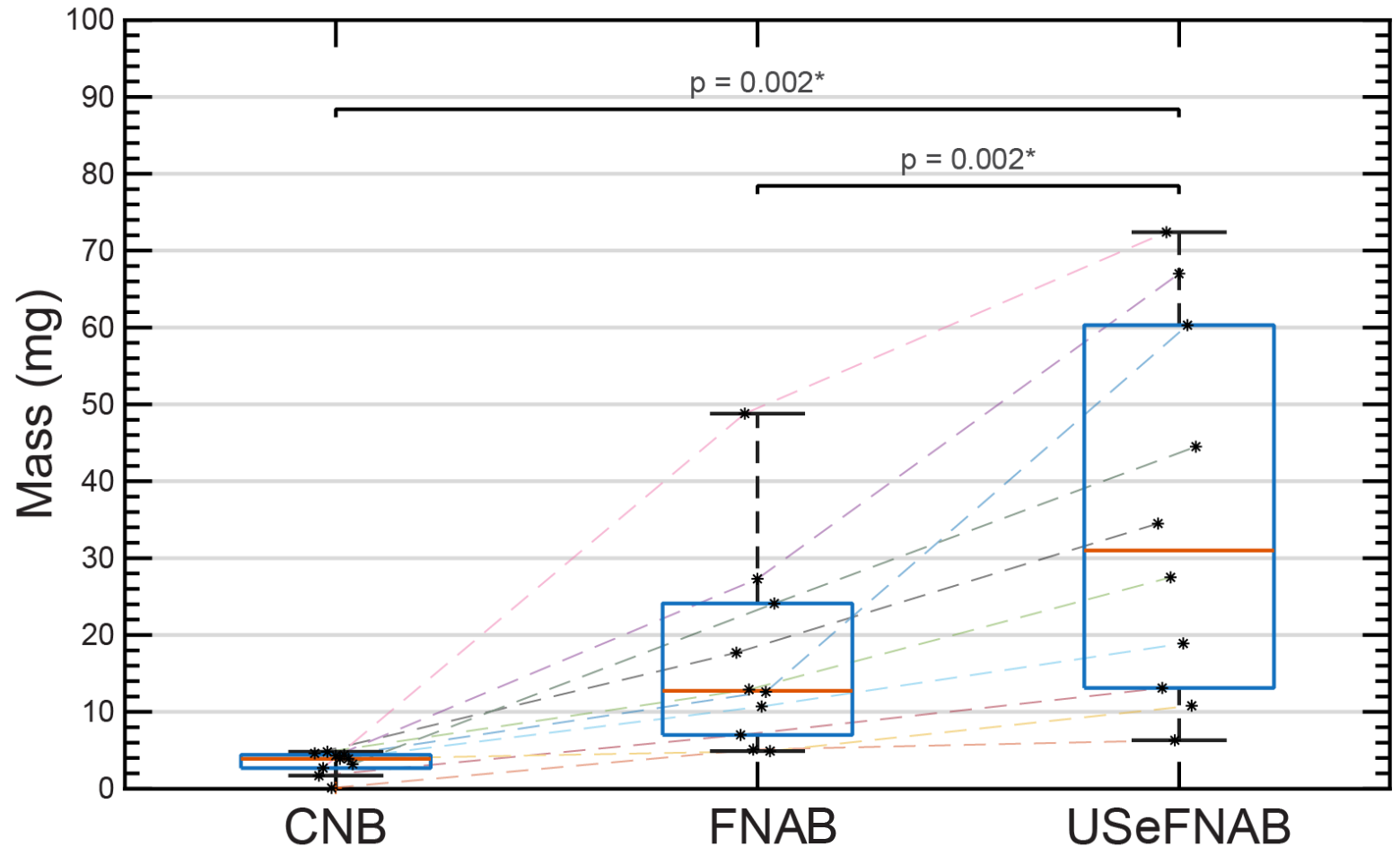
Thyroid

Results



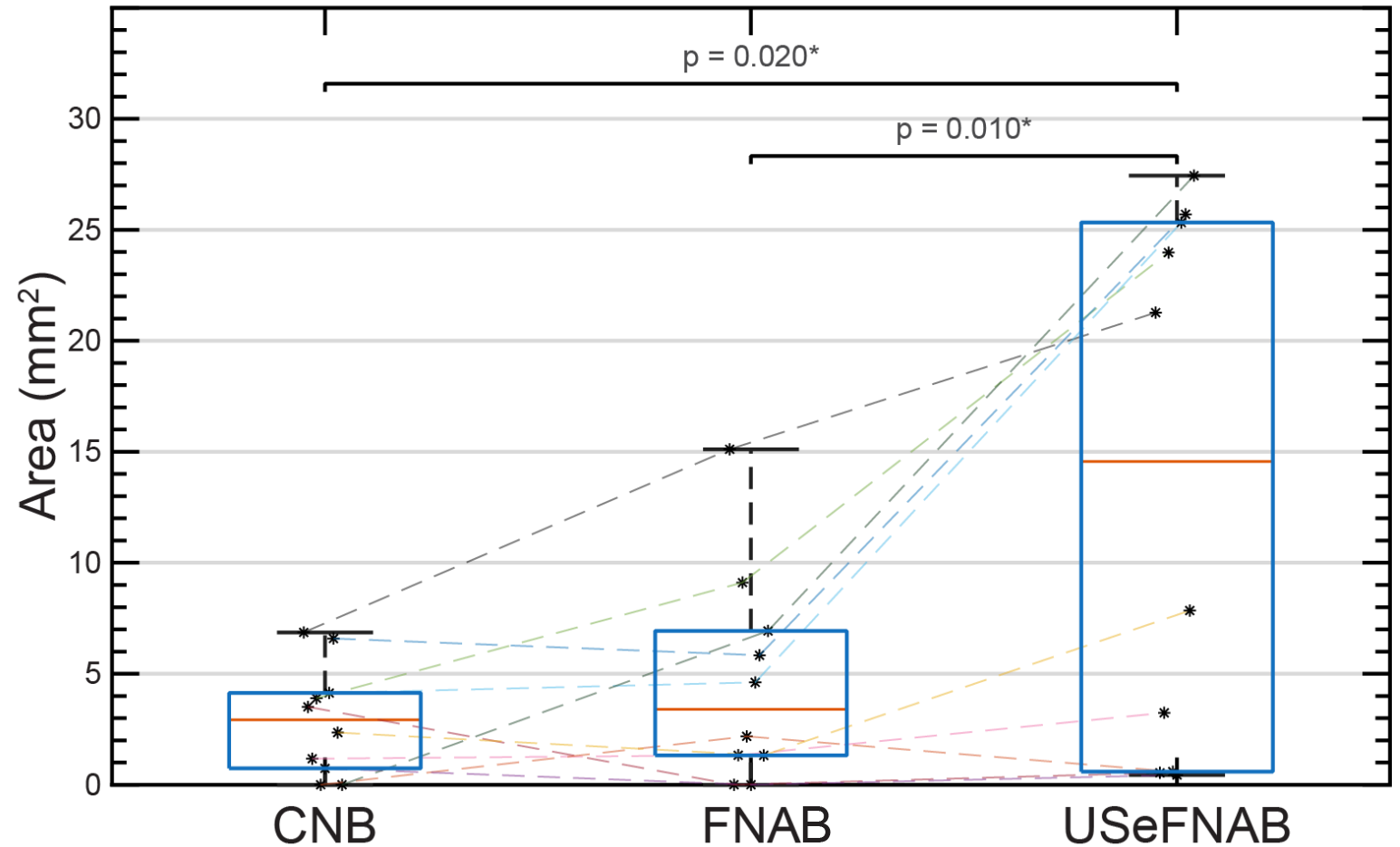
Tissue mass collected

- Yield increase in USeFNAB by **2.1x** and **10.6x** as compared to FNAB or CNB, respectively.

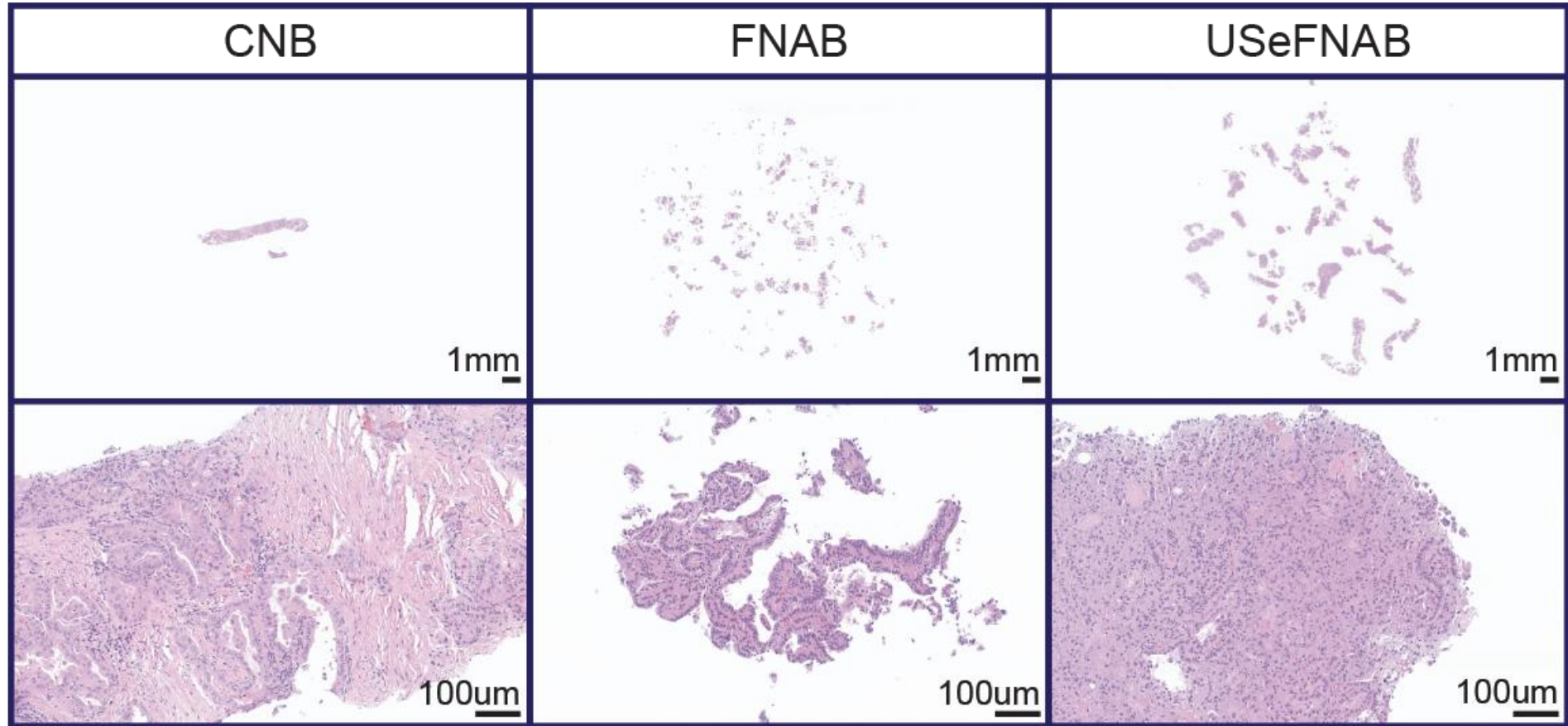


Tissue area on histological slide

- Tissue area increase in USeFNAB by **2.9x** and **3.2x** as compared to FNAB or CNB, respectively.
- Sample quality in USeFNAB comparable to FNAB or CNB.



Exemplary histological slide



Conclusion

- **Biopsy yield increased from 2.1 to 10.6 times** as compared to the state-of-the-art methods.
- **Tissue area** on histological slide **increased from 2.9 to 3.3** as compared to the state-of-the-art methods.
- **Tissue quality** was found to be **equivalent** to that obtained with the state-of-the-art methods.

USeFNAB demonstrated potential to be useful in **human thyroid cancer**.



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