

Nano-biomarker-Based Surface-Enhanced Raman Spectroscopy for Non-Invasive Discrimination of Kidney Transplant Rejection

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Disclosure

I have NO financial disclosure or conflicts of interest with the presented material in this presentation.

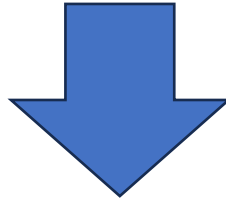
Kidney transplantation (KT) serves as the gold standard treatment for ESRD

Acute rejection (AR) remains a major cause of renal transplant failure

Biopsy is still the gold standard → invasive, sampling errors, pt. discomfort, complications

Need an alternative, less invasive and novel technique for rejection detection methods

Raman Spectroscopy utilizes the interaction of laser light with molecular vibrations within biological tissues to provide valuable information about the molecular composition and structure of the tissue

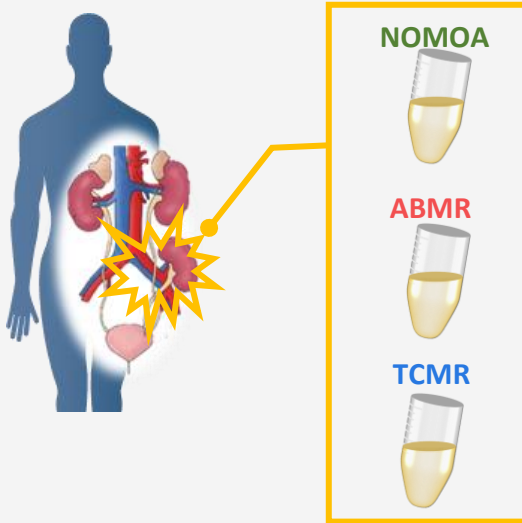


Differentiating rejection types in KT patients

Methods

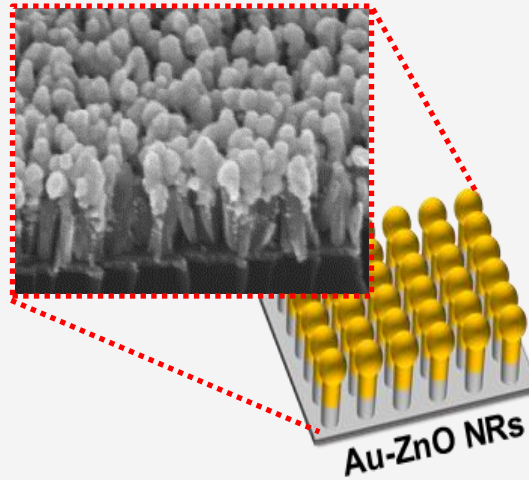
Phase I: Preparation phase

01 Obtaining samples from patients (3 different groups)



*NOMOA: No Major Abnormalities

02 Fabrication of nano-structured SERS chip



*SERS: Surface-enhanced Raman spectroscopy

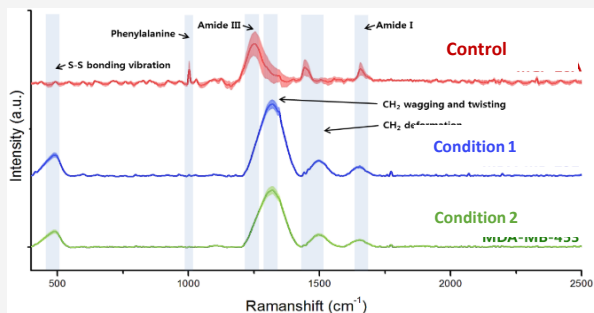
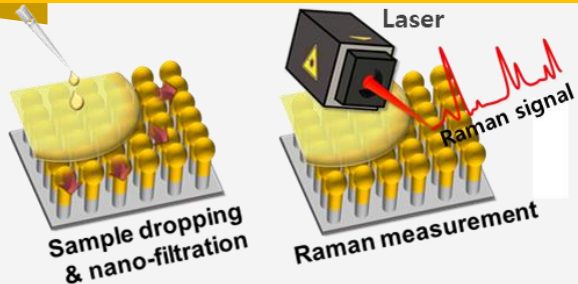
03 Set-up of actual Raman spectroscopy system



Methods

Phase II: Measurement & Analysis phase

Obtaining Raman spectra measurements

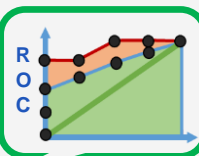
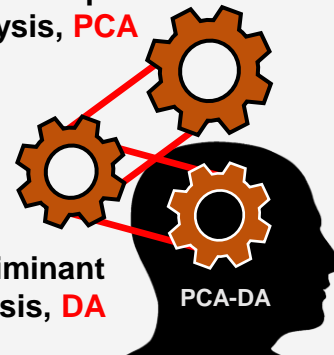


Phase III: Measurement & Analysis phase

Application of machine learning algorithms

Principal Component Analysis, **PCA**

Discriminant Analysis, **DA**

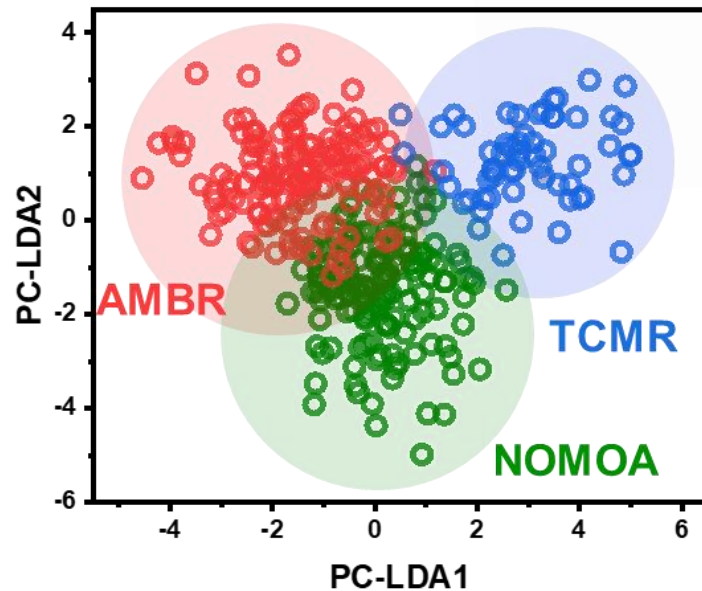
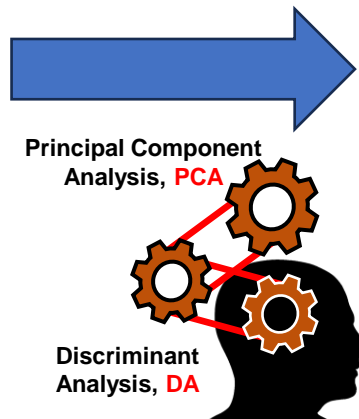
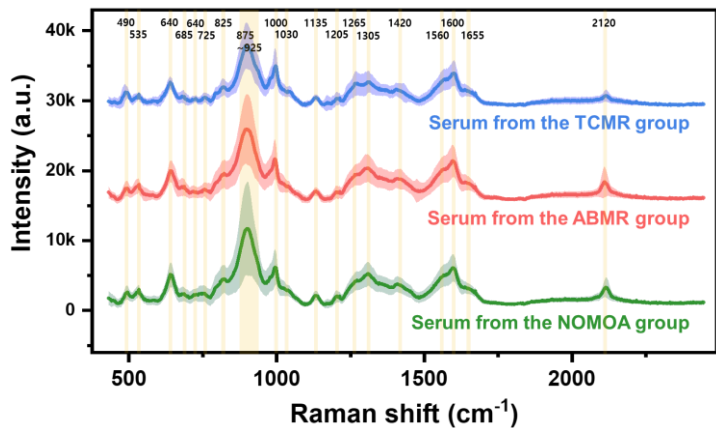


Confusion Matrix

F1	40	0	0
F2	0	37	0
F3	0	3	40
	F1	F2	F3

Results

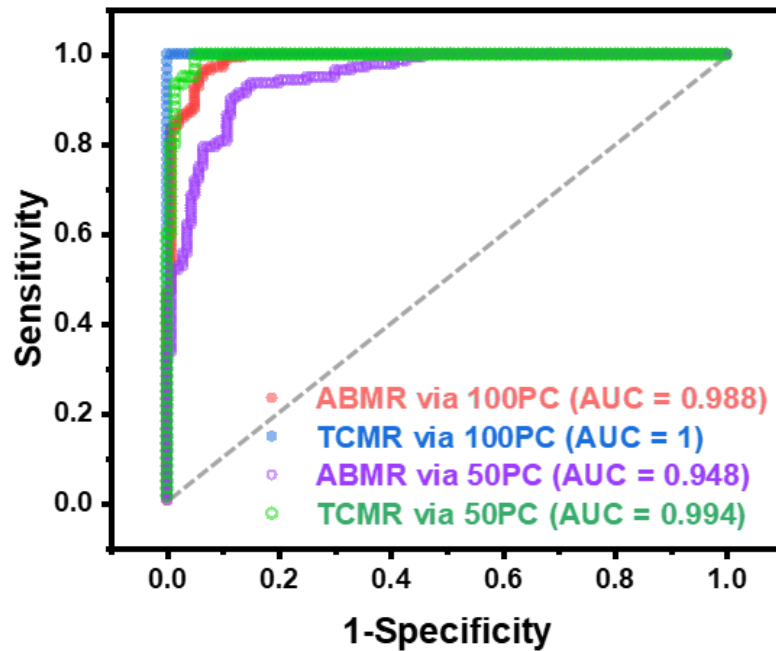
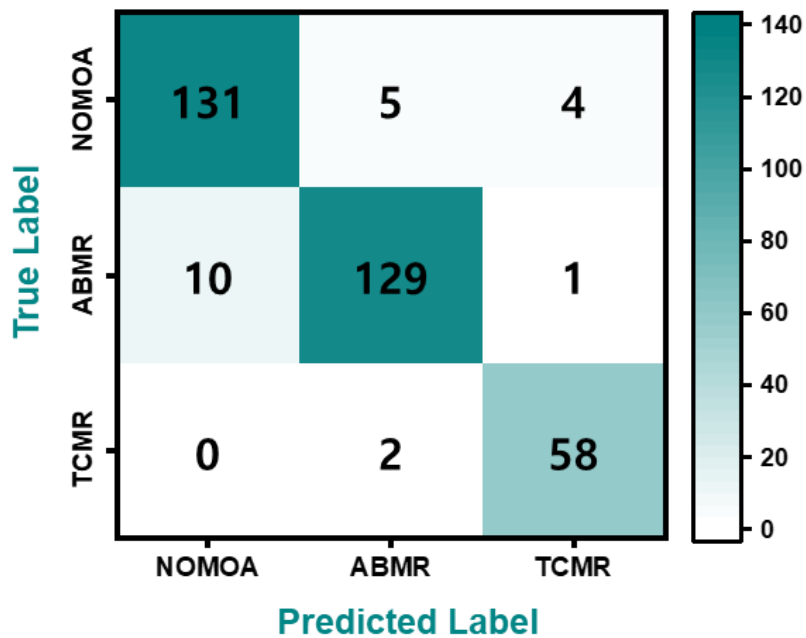
Application of machine learning algorithm



Distinctive grouping of each rejection type

RESULTS

Confusion matrix & ROC curve



Conclusion

1

We **successfully obtained distinctive Raman spectra** for 3 groups: NOMOA, ABMR, TCMR

2

RS can be implemented as a novel, less invasive technique with **high specificity for differentiating** rejection types

3

Need to validate with more samples with broader range, figure out the **responsible molecules for specific peaks** by Raman assignment





THANK YOU

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