Characterization of Oral Tactile Sensitivity and Masticatory Performance Across Adulthood

Grace Shupe, Zoe Resmondo, & **Curtis R. Luckett**

THE UNIVERSITY OF TENNESSEE KNOXVILLE

Individual Variation in Texture Perception

- **Oral processing**
- **Tactile Sensitivity**
  - Surface characteristics
  - Salivary output
  - Salivary composition
  - Genetics

- Inherent differences in human perception represent a major aspect of the variation in product judgements.
- The sources of the individual differences also shed light on the factors governing texture perception.

Oral Processing

Masticatory Feedback Loop

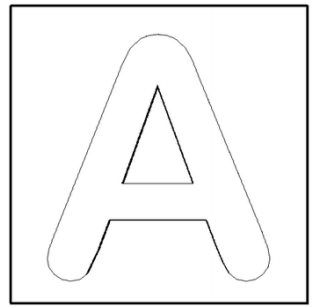
- Chewing is driven by rhythmic contractions of muscles generated by central patterns in the brainstem.
- Tactile feedback is used to modify masticatory motor movements

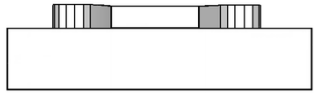
Tactile feed back is used to:

- Determine jaw placement and avoid discomfort while chewing due to an unintended collision of teeth
- Locate and assess in the oral cavity food particles
- Optimize chewing patterns to breakdown foodstuffs

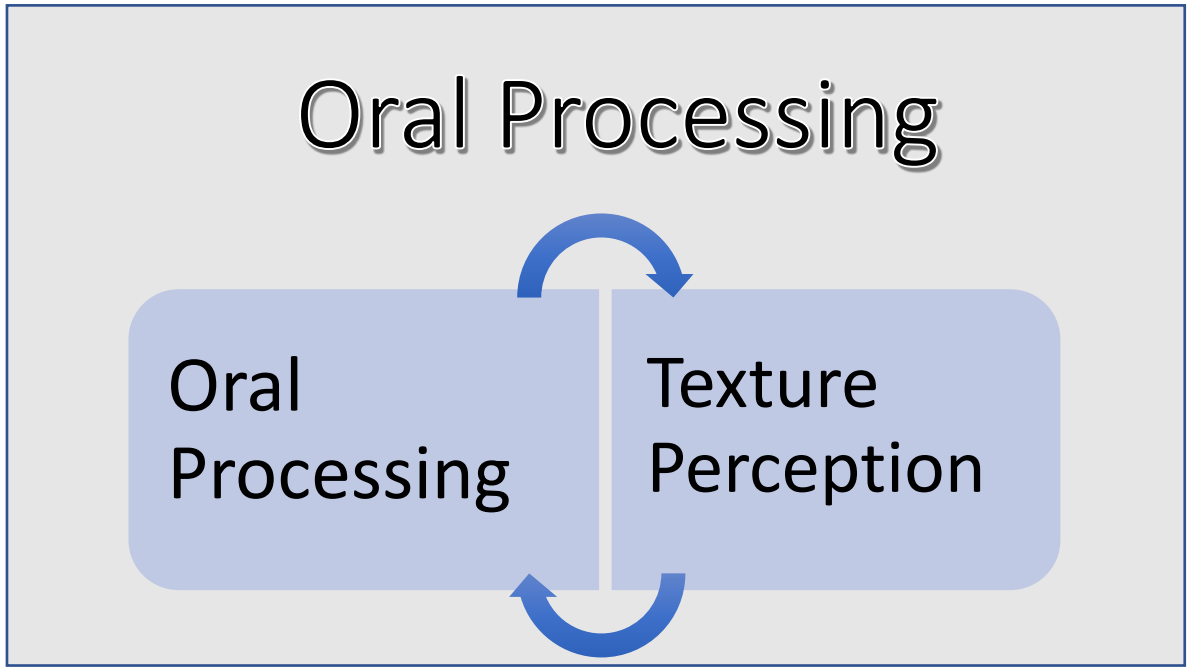
Oral Tactile Sensitivity

- Essick's Oral Lingual Stereognosis
- Semmes-Weinstein Monofilament
- Granulation Discrimination
- Two-point Discrimination
- Roughness Threshold
- Pressure Sensitivity
- Etc.





It isn't known which measures of sensitivity focus on how texture is perceived then **relayed back into the masticatory feedback loop**.

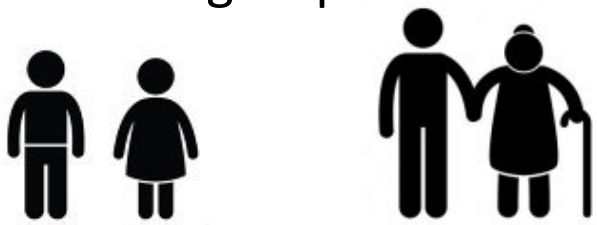


1

Test for oral sensitivity using oral stereognosis, lingual tactile acuity, and bite force sensitivity.

2

Quantify across age groups.



3

Relate to mastication performance

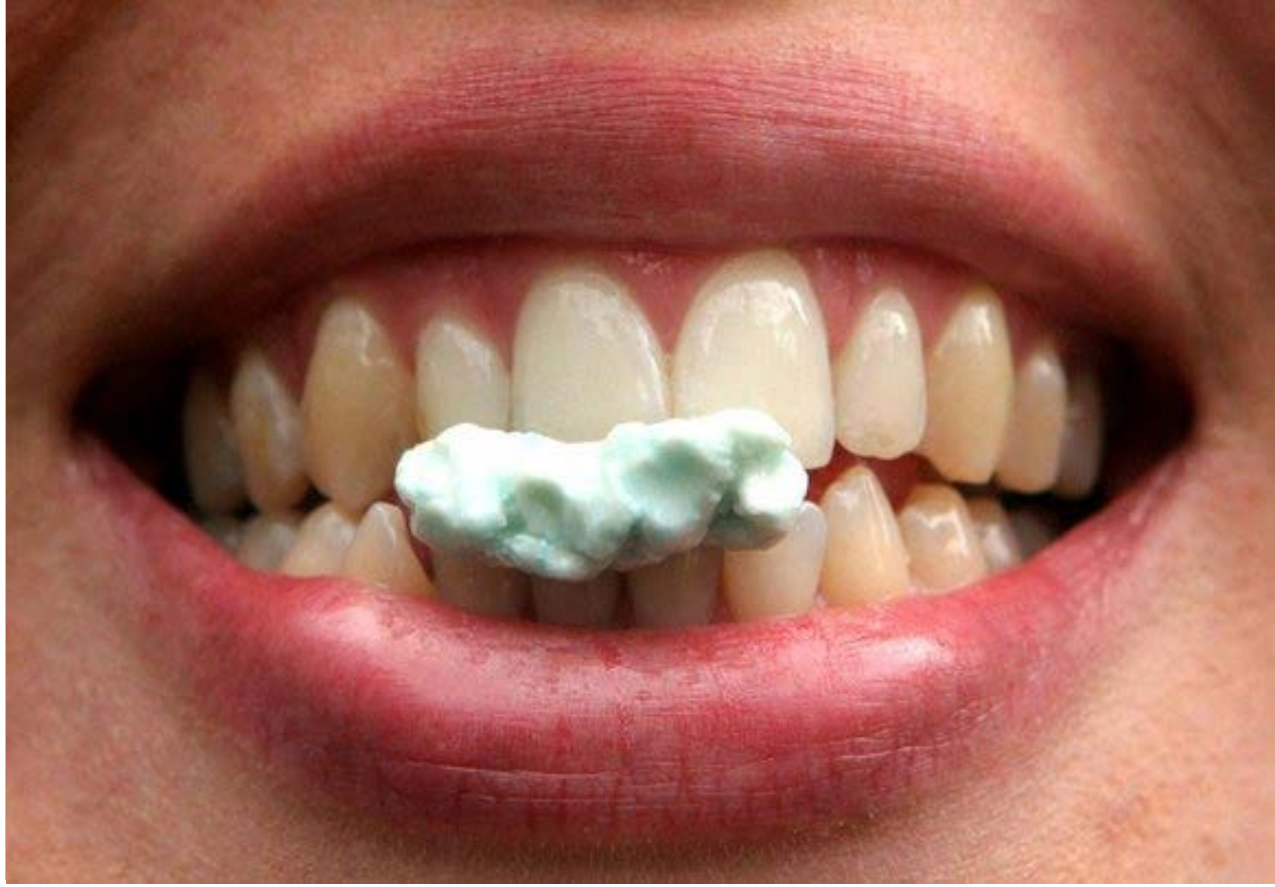
What measure of oral tactile sensitivity are important for chewing?

Participants

- N=98, 57% Female
- Screened by Age Group
  - 20-25
  - 35-45
  - >62
- Self-Report common dental procedures

Demographics		Age Group		
		Young	Middle	Old
Age	N	34	31	28
	Mean	22.5 ± 1.6	40 ± 3.1	73 ± 6.1
	Max	25	45	87
	Min	20	35	63
Gender	Female	22	18	16
	Male	12	13	12

* Mean values have SD as the error term.



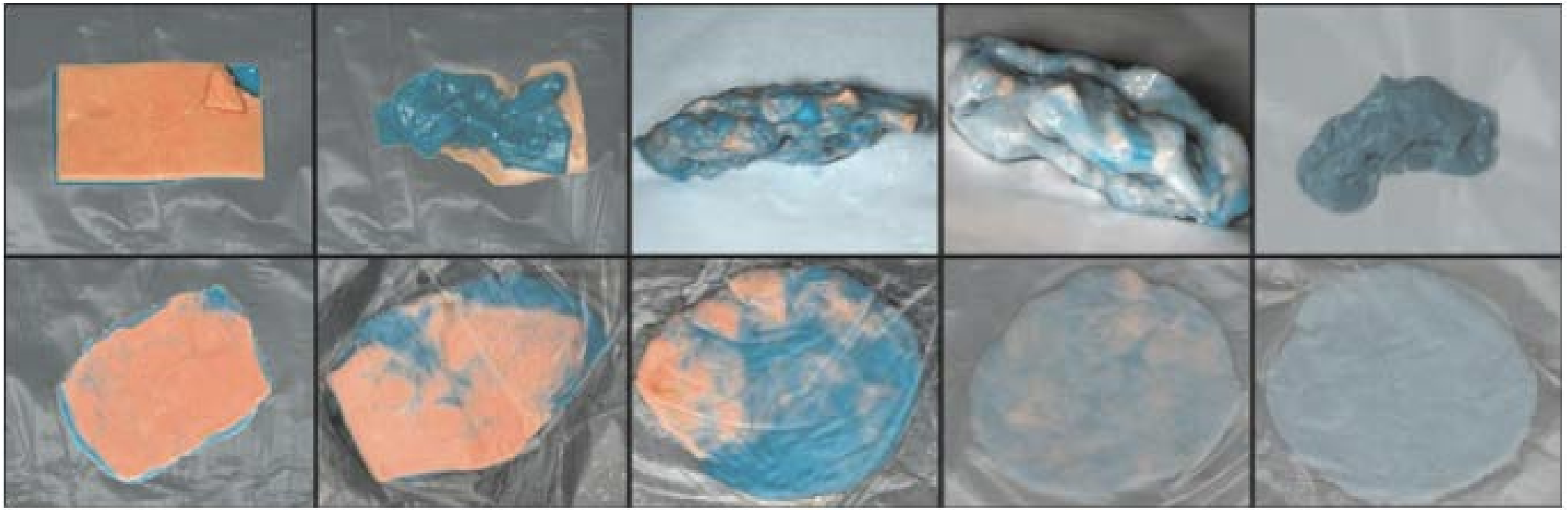
Oral Sensitivity

Mastication Performance

Oral Sensitivity Tasks

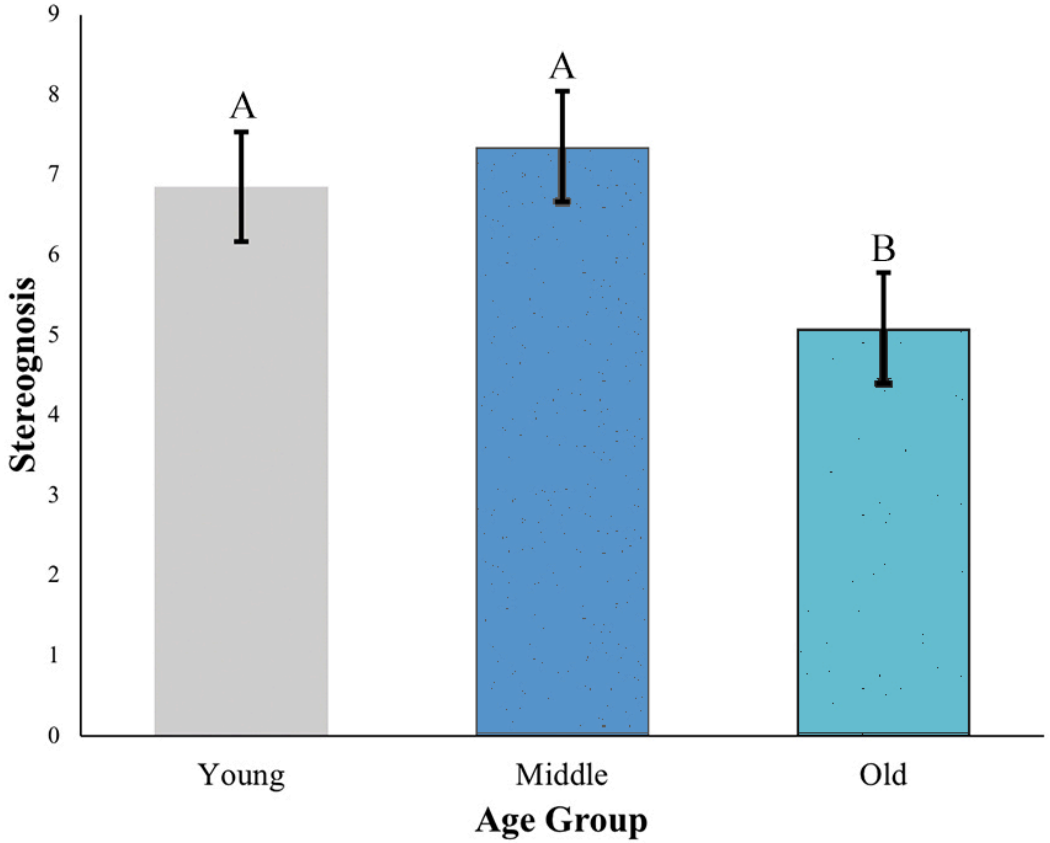
Oral Stereognosis	Confectionary Alphabet Letters 
Bite Force Sensitivity	2-AFC with foam of different compression factors
Lingual Tactile Acuity	10 Shape Stimuli (raised and recessed orientations) 

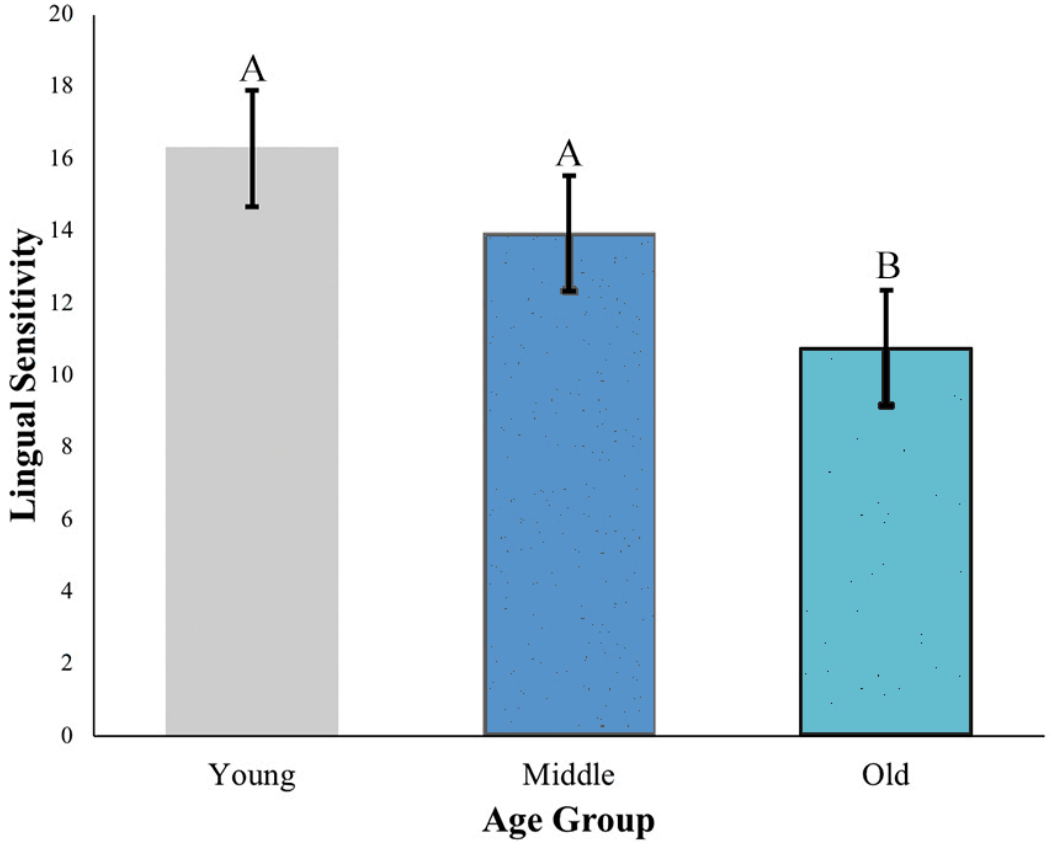
$$Oral\ Stereognosis + Bite\ Force\ Sensitivity + Lingual\ Tactile\ Acuity = \boldsymbol{Total\ Index}$$

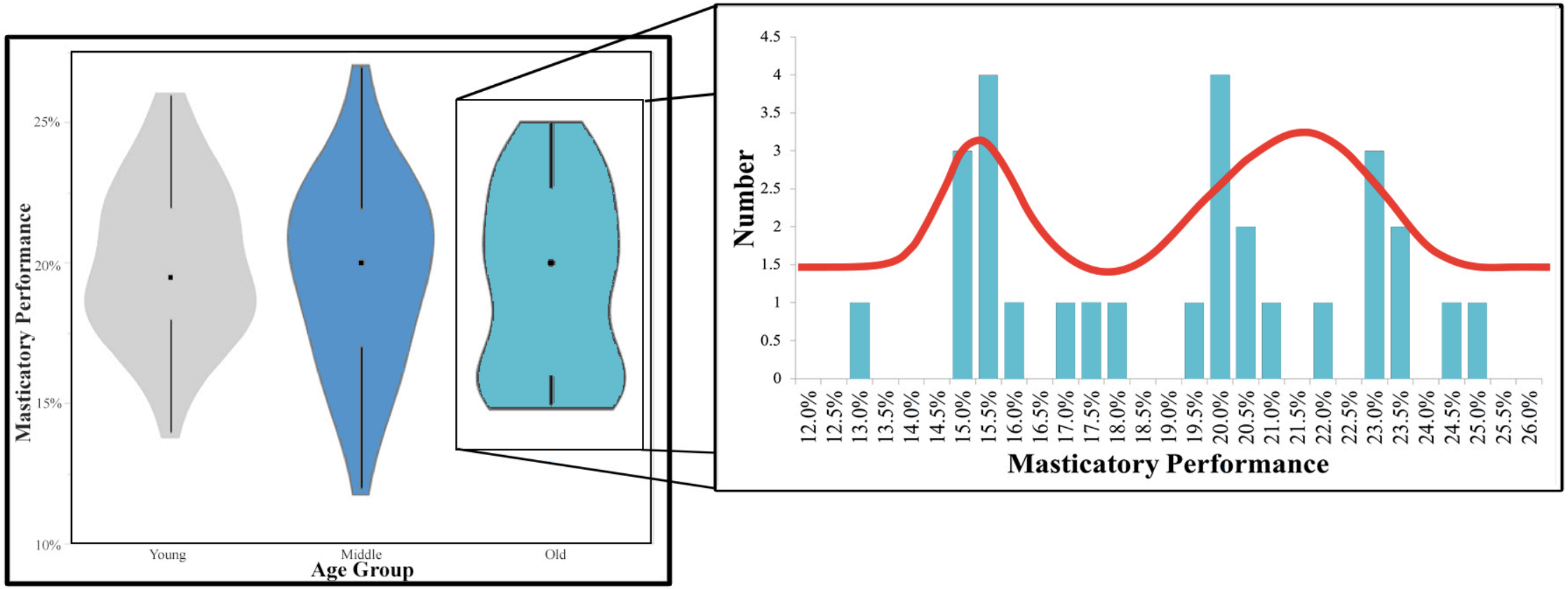


- Mixing Ability
  - Two-color gum sample
  - 10 Seconds

Mastication Performance


Stereognosis
9
8
7
6
5
4
3
2
1
0
A
A
B
Young
Middle
Old
Age Group


Lingual Sensitivity
20
18
16
14
12
10
8
6
4
2
0
A
A
B
Young
Middle
Old
Age Group


Masticatory Performance
25%
20%
15%
10%
Young
Middle
Old
Age Group
Number
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
12.0%
12.5%
13.0%
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25.5%
26.0%
Masticatory Performance

	Age	Dental status	Masticatory performance	Stereognosis	Lingual sensitivity	Bite force sensitivity
Age	–	–0.5859**	–0.1037	–0.3978**	–0.3881**	–0.0593
Dental status		–	0.1193	0.2364*	0.2244*	0.0485
Masticatory performance			–	0.0429	0.0657	0.0771
Stereognosis				–	0.4648**	0.0027
Lingual sensitivity					–	0.0030
Bite force sensitivity						–

*Significant at the 0.05 level.
**Significant at the 0.0001 level.

Pearson's Correlations

Conclusions

- Individual differences were found for all sensitivity tests and masticatory performance
- Changes in oral sensitivity did not relate to masticatory performance
- Age was a significant factor in some measures of oral sensitivity
  - Aging effect is heterogenous – declines in some but not all

1

Test texture discrimination ability

2

Measure oral processing

3

Completed using two groups

- Low Sensitivity (Lower 25%)
- High Sensitivity (Upper 25%)

How does oral sensitivity relate to mastication and sensitivity to texture changes?

Participants

High Sensitivity

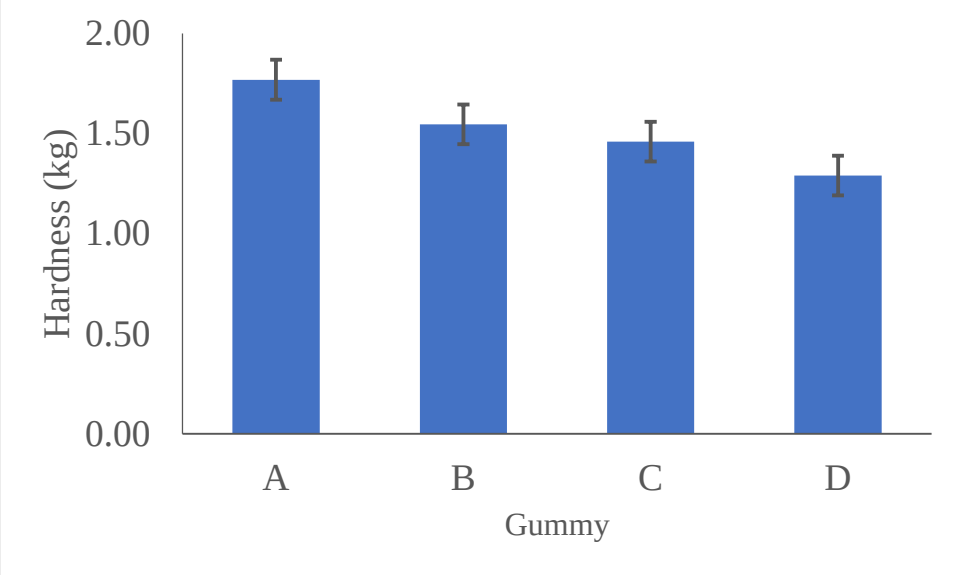
N=11

Low Sensitivity

N=21

Discrimination Ability

- Triangle Testing
- Four different gelatin hardness's:



Oral Processing

- Jaw tracking utilized to determine masticatory behavior.

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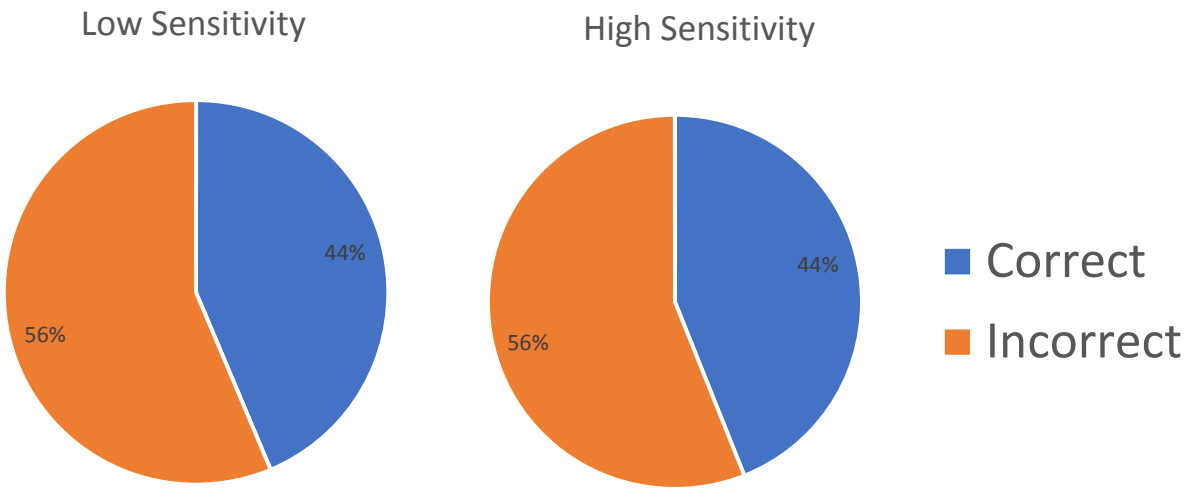
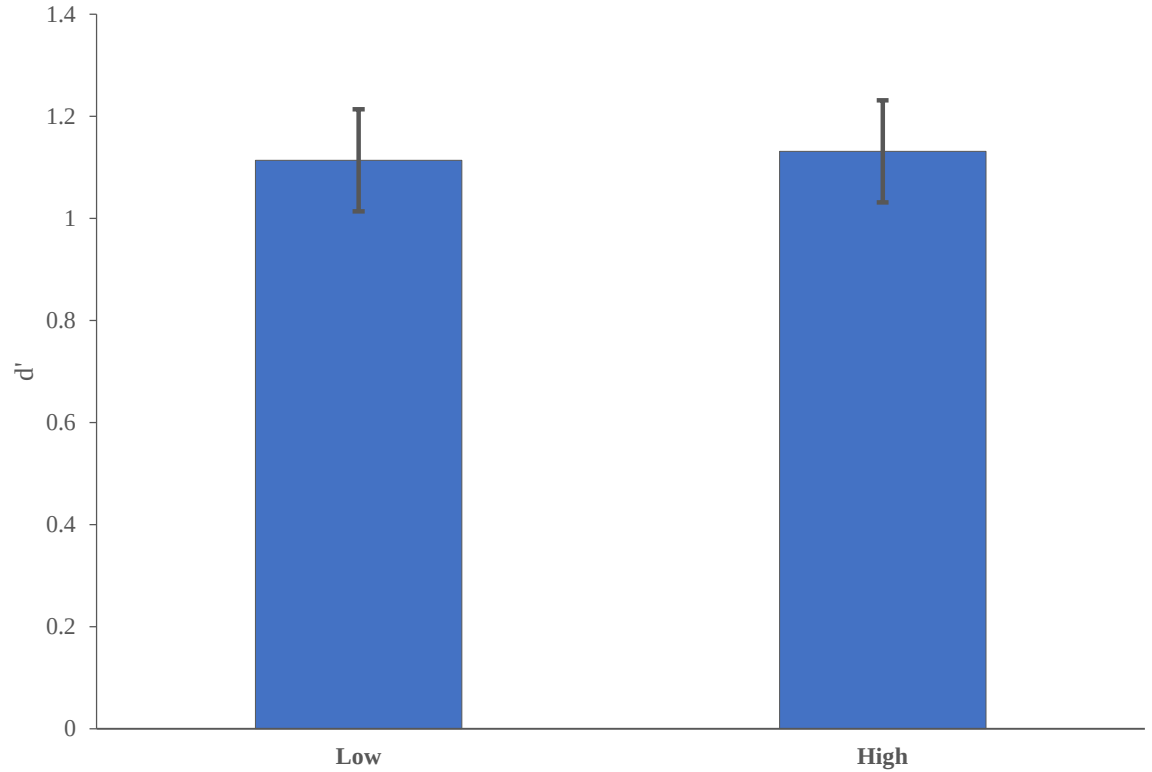
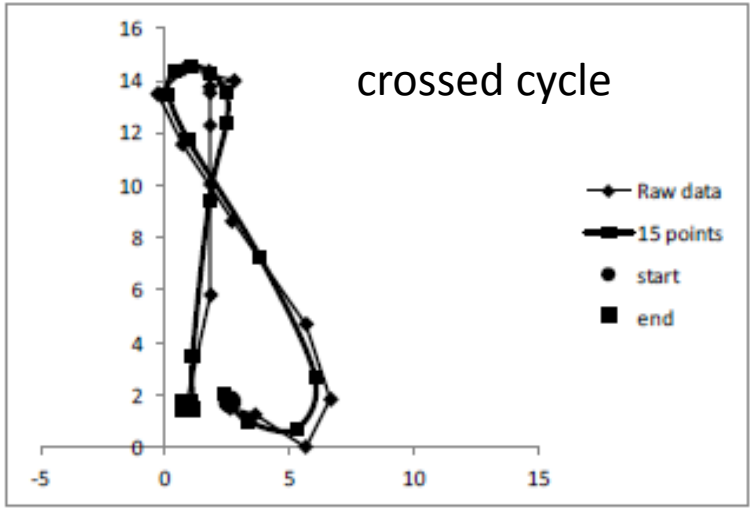
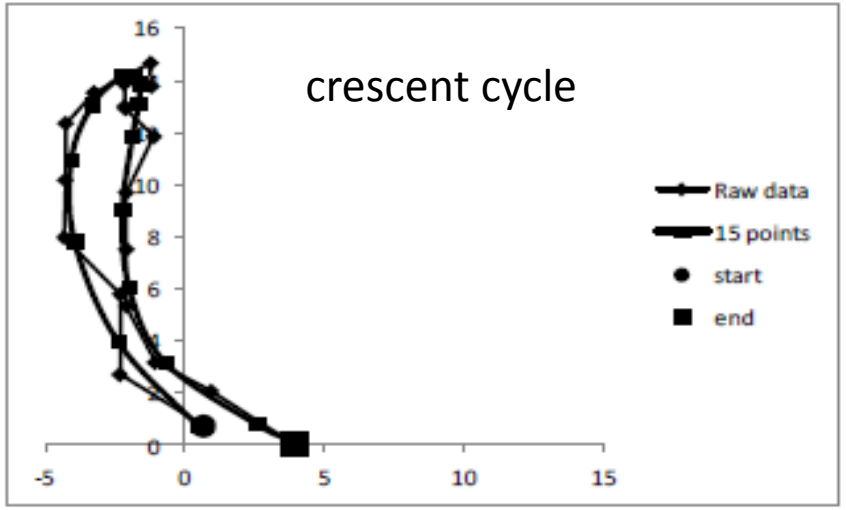
Discriminatory Ability

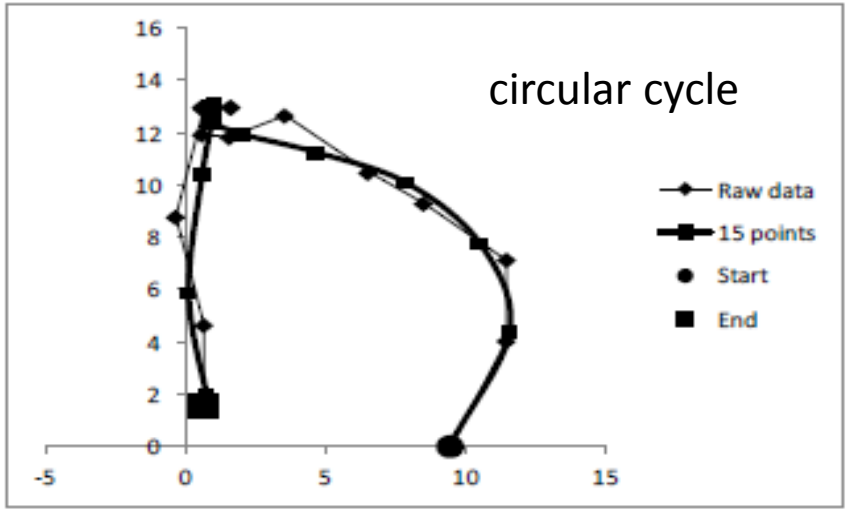




More common in individuals with low sensitivity ($p < 0.05$)

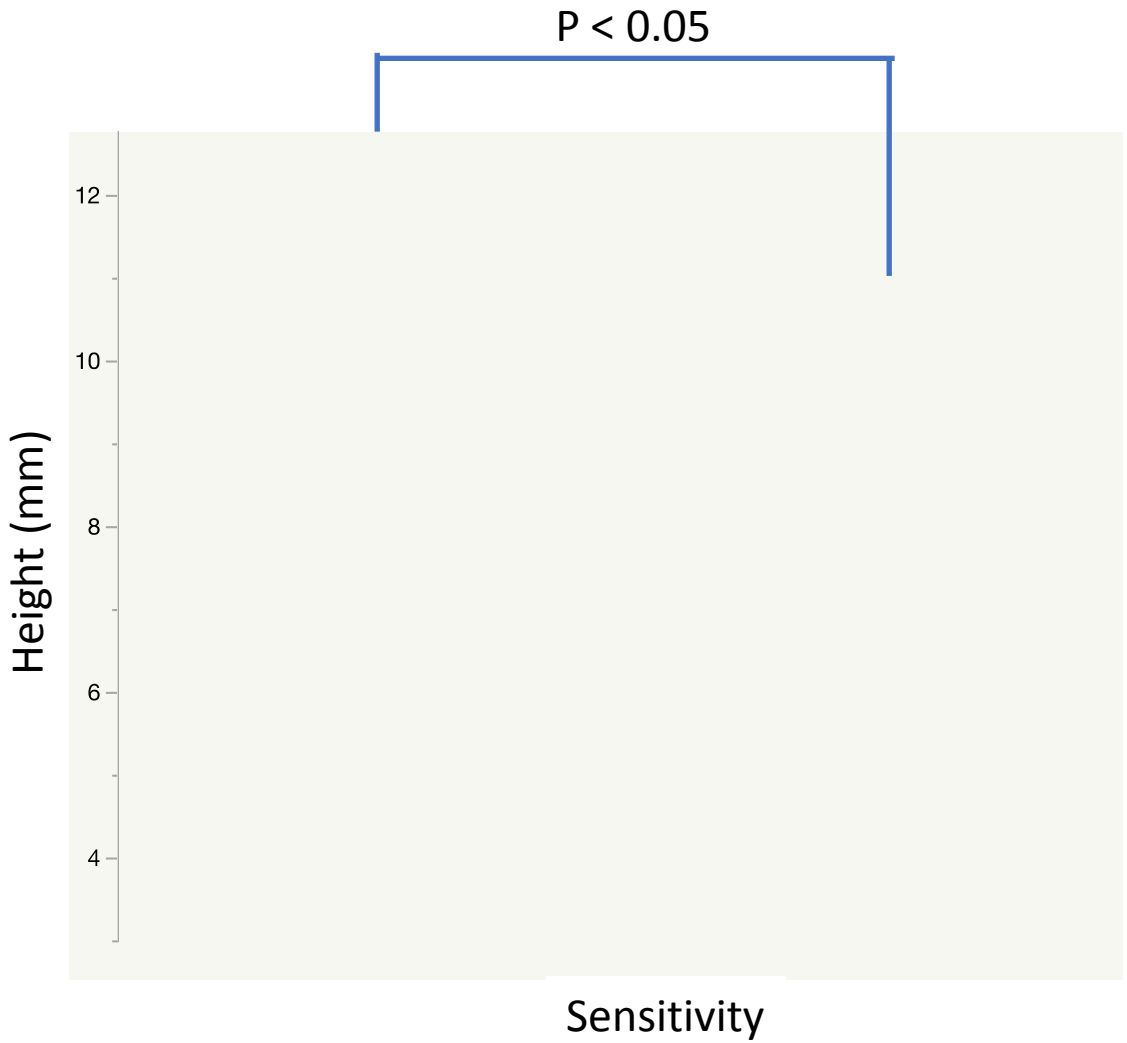


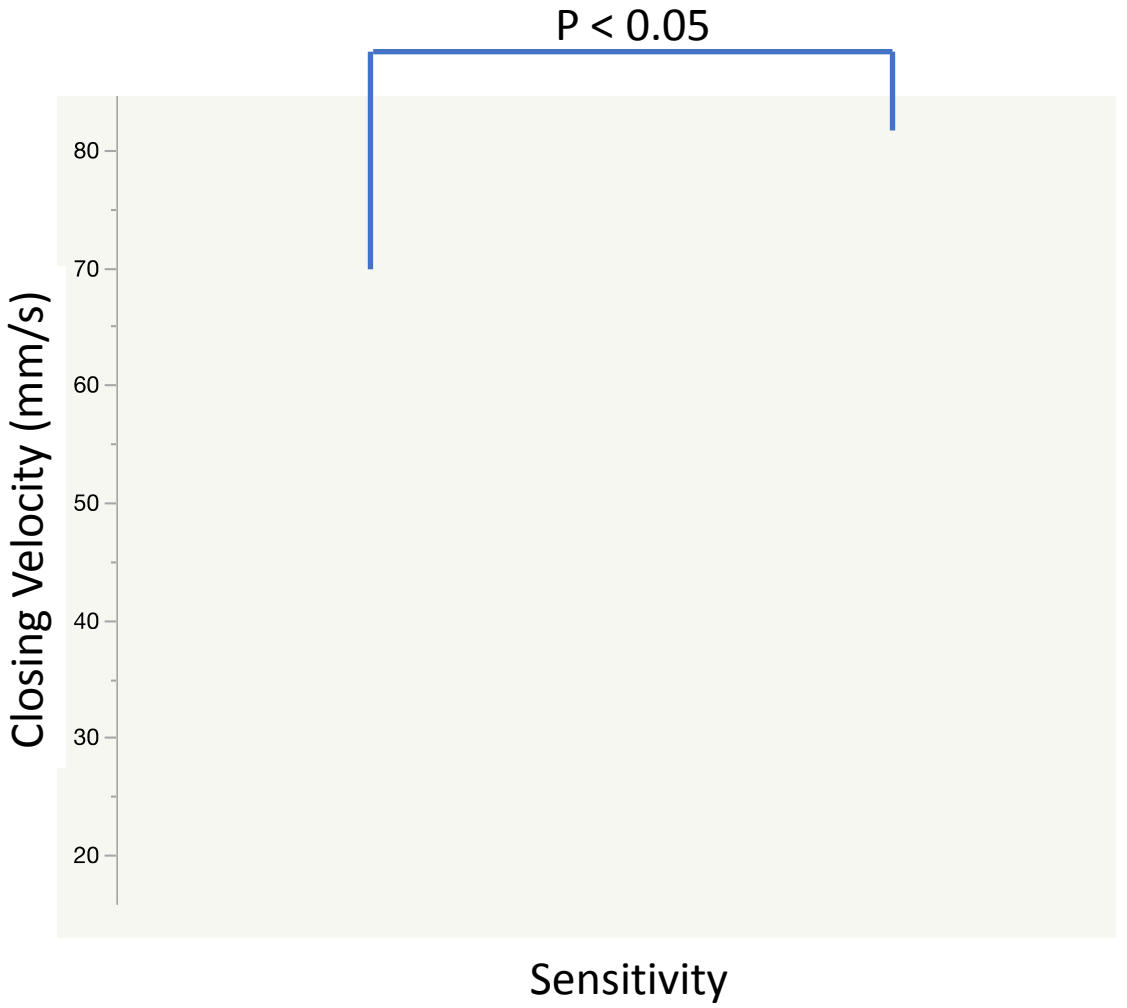




- High sensitivity participants were much more likely to have chews not fitting a pattern ($p < 0.05$)
- More dynamic mastication patterns are evidence of greater tactile feedback
  - Using tactile information to modify mastication pattern

Effect of Oral Tactile Sensitivity on Mastication Parameters





Overall Conclusions

- **Oral sensitivity scores modulated with age.**
- **Texture discrimination not influenced by oral sensitivity**
- **Mastication performance was not affected by sensitivity.**
- **Oral tactile sensitivity influences chewing behavior**

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