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## Introduction

- Arcuate Fasciculus (AF), connecting Broca's and Wernike's area
  - ✓ Involved in Repetition, Prosody, Transmission, Speech Production
- Inferior Longitudinal Fasciculus (ILF), connecting the ventral temporo-occipital regions
  - ✓ Involved in Semantic recognition of Visual Information, Lexical Retrieval, and Reading Processing
- Overseas, many studies have examined the quantitative properties of language-related white matter, such as AF and ILF
  - ✓ But such research is limited in Korea
- Aim: To quantitatively analyze age-related changes in Fiber Number (FN) and Fractional Anisotropy (FA) of AF and ILF

## Methods

- Design : Retrospective study
- Inclusion criteria: Healthy individuals from newborn to under 19
- Exclusion criteria
  - ✓ Neurological disorders (e.g., Epilepsy) / Developmental delay / Cases deemed unsuitable for clinical research
- Age-based Group Classification
  - ✓ group 1: below 6 years (n=12) / group 2: 7-13 years (n=11) / group 3: 14-19 years (n=10)
- Measurement of FA and FN values of AF and ILF using DTIstudio
- Statistic
  - ✓ Mean ± standard deviation of FA and FN for AF and ILF in each group
  - ✓ Correlation test to examine the relationship between age and change in FA and FN
  - ✓ One-way ANOVA and Kruskal-Wallis test to analyze group differences in FA and FN of AF and ILF

## Results

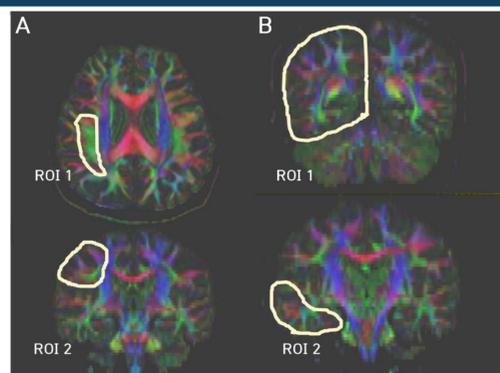


Fig 1. Method for Defining ROIs of AF and ILF using DTIstudio. (A) ROI of AF, (B) ROI of ILF.

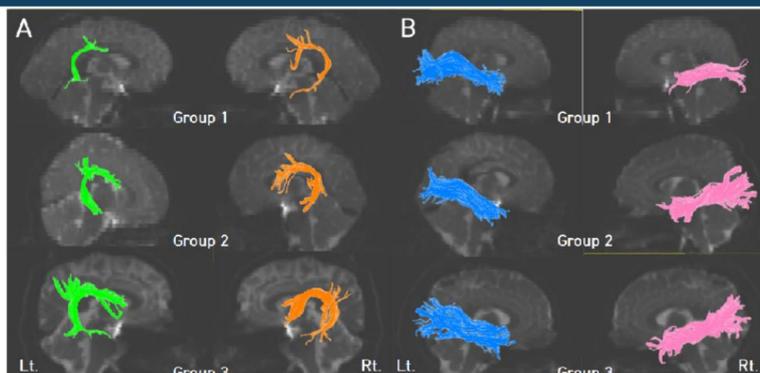


Fig 2. The visualization represents AF and ILF by group. (A) AF with increasing age, (B) ILF increasing age.

**Table 1. Values of AF and ILF by Group & Correlation between Age**

|     |                  | Rt.       |           |           |                     | Lt.       |           |           |                     |
|-----|------------------|-----------|-----------|-----------|---------------------|-----------|-----------|-----------|---------------------|
|     |                  | Group 1   | Group 2   | Group 3   | r                   | Group 1   | Group 2   | Group 3   | r                   |
| AF  | FN <sup>1)</sup> | 195.25    | 384.27    | 557.60    | <i>r=0.583**</i>    | 185.58    | 414.09    | 750.00    | <i>r=0.813**</i>    |
|     |                  | ±288.25   | ±221.71   | ±364.72   | <i>p&lt;0.001**</i> | ±260.53   | ±182.25   | ±161.39   | <i>p&lt;0.001**</i> |
|     | FA <sup>2)</sup> | 0.23±0.22 | 0.51±0.04 | 0.51±0.02 | <i>r=0.748**</i>    | 0.21±0.23 | 0.49±0.01 | 0.52±0.02 | <i>r=0.899**</i>    |
|     |                  |           |           |           | <i>p&lt;0.001**</i> |           |           |           | <i>p&lt;0.001**</i> |
| ILF | FN <sup>1)</sup> | 574.25    | 942.18    | 1230.00   | <i>r=0.642**</i>    | 729.17    | 1000.91   | 1309.80   | <i>r=0.571**</i>    |
|     |                  | ±391.93   | ±428.12   | ±303.22   | <i>p&lt;0.001**</i> | ±432.09   | ±408.47   | ±450.12   | <i>p&lt;0.001**</i> |
|     | FA <sup>2)</sup> | 0.30±0.18 | 0.53±0.04 | 0.54±0.02 | <i>r=0.805**</i>    | 0.31±0.16 | 0.54±0.02 | 0.54±0.03 | <i>r=0.779**</i>    |
|     |                  |           |           |           | <i>p&lt;0.001**</i> |           |           |           | <i>p&lt;0.001**</i> |

Data values are given as means ± SD; 1) Pearson, 2) Spearman; Rt, Right; Lt. Left; AF, Arcuate Fasciculus; ILF, Inferior Longitudinal Fasciculus; FN, Fiber Number; FA, Fractional Anisotropy; \*p<0.05; \*\*p<0.01

**Table 2. Comparison of AF and ILF Values Between Groups**

|     |     | Between Groups   |                  | G1 - G2          |                  | G1 - G3          |                  | G2 - G3          |                  |
|-----|-----|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|     |     | FN <sup>1)</sup> | FA <sup>2)</sup> |
| AF  | Rt. | 0.025*           | <0.001**         | 0.313            | <0.001**         | 0.025*           | <0.001**         | 0.415            | 0.746            |
|     | Lt. | <0.001**         | <0.001**         | 0.046*           | 0.009**          | <0.001**         | <0.001**         | 0.004**          | 0.022*           |
| ILF | Rt. | 0.001**          | <0.001**         | 0.085            | <0.001**         | 0.002**          | <0.001**         | 0.240            | 0.787            |
|     | Lt. | 0.014*           | <0.001**         | 0.331            | <0.001**         | 0.014*           | <0.001**         | 0.274            | 0.999            |

1) One-way ANOVA, 2) Kruskal Wallis H test, 3) post-hoc test; Rt, Right; Lt. Left; G, Group; AF, Arcuate Fasciculus; ILF, Inferior Longitudinal Fasciculus; FN, Fiber Number; FA, Fractional Anisotropy, \*p<0.05; \*\*p<0.01

- Both FA and FN of AF and ILF showed significant differences among groups
  - Group 1 vs. Group 3: Significant differences in both FA and FN of AF and ILF
  - Group 1 vs. Group 2: Significant differences in FA of AF and ILF, while FN showed a significant difference only AF
  - Group 2 vs. Group 3: Significant differences in both FA and FN of AF
- No significant differences were found in FA and FN between the left and right hemisphere for AF and ILF

## Conclusion

- FA and FN of AF and ILF showed significant differences with increasing age
- Significant differences in FA and FN values of AF and ILF were observed between the below 6 and the 13+ groups
- For AF, FA and FN also showed significant differences between the 7-13 years group and 13+ years group
- Within each group, there were no significant differences in FA and FN values of AF and ILF between left and right hemispheres