Fig. 5. Face images at characteristic timing positions for facial expression intensity value of subject A; upper: 0 (starting point), lower left: maximum, lower right: minimum except that at starting point.

Table 1. Feature parameters for facial expressions and movements.

(1) With size standardization before extracting mouth area

| Subject | Utterance | | Feature parameter | |
|---|---|---|---|---|
| | A | B | Facial expression | Movement of person |
| **A** | without | without | 11.41 | 0.05 |
| | with | without | 9.47 | 0.08 |
| | without | with | 10.50 | 0.05 |
| | B | A | | |
| **B** | without | without | 4.53 | 0.05 |
| | with | without | 12.51 | 0.07 |
| | without | with | 3.14 | 0.06 |

(2) Without size standardization before extracting mouth area

| Subject | Utterance | | Feature parameter | |
|---|---|---|---|---|
| | A | B | Facial expression | Movement of person |
| **A** | without | without | 8.55 | 0.03 |
| | with | without | 8.50 | 0.04 |
| | without | with | 10.06 | 0.05 |
| | B | A | | |
| **B** | without | without | 5.48 | 0.04 |
| | with | without | 10.88 | 0.05 |
| | without | with | 5.18 | 0.03 |

before extracting the mouth area, while it was increased for subject B from 27 to 138 by standardization. Though mouth-area images were influenced by size standardization before extracting the mouth area (Fig. 2), the feature parameter values of both facial expressions and movements of subjects were not influenced so much by size standardization before extracting the mouth area (Table 1). The value of the feature parameter for facial expression was relatively high for subject A in all three cases, whereas it was relatively high for subject B in the only case that subject B spoke and subject A did not speak (Table 1). Because the period in which both subjects A and B spoke was very short, the data are not described in Table 1.

## 4. Conclusion

A video is analyzed by image processing and the newly proposed feature parameters of facial expressions and movements. The experimental result shows the usefulness of the proposed method. In future work, we will develop the method for estimating the mental state and/or recognition ability of a patient by using the proposed method.

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