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　　　　　This study aimed to examine the understanding of forced smiles in individuals with autism spectrum disorder (ASD). We recruited 26 (10 with ASD and 16 with neurotypical development [ND]) participants who were asked to define forced smiles, rate Kikuchi's Scale of Social Skills, and distinguish the forced smiles from natural laughter. Their gaze movement was measured via an integrated eye tracker . The results indicated that the definition of the forced smile was the same between the two groups. The ND group correctly distinguished. We found a positive correlation between social skill scores and correct forced smile distinction scores in the ND group. We found differences in the eye movement, length of visual fixation, and fixation count between low and high-score cases in the ASD group. We discussed the understanding of forced smiles with respect to the concepts of propositional/intuitive mentalizing and weak central coherence.

１．研究開始当初の背景

The "forced smile" phenomenon refers to the social skills that are routinely used by many to maintain smooth social relations (Oshimi, T., 1999). The characteristic form of expression of the Japanese culture is a restrained negative expressiveness and an explicit expression of positive feelings. Displaying a particularly conspicuous maladaptive behavior in such situations is a symptom of the autism spectrum disorder (ASD). ASD is among the most common neurodevelopmental disorders. This study aimed to understand the atypical development in persons with ASD and the typical development (TD) of social metacommunication. Although the forced smile phenomenon is important for maintaining human relations, a review of the literature on social skills development of people with ASD reveals that not much is known about it academically. A weak central coherence (Frith, U., 2004) that is suggested to characterize ASD may impact whether a forced smile is understood through intuitive mentalizing or through verbal proposition mentalizing.

２．研究の目的

Therefore, this study aimed to shed light on the recognition of forced smiles in people with ASD.The general hypothesis was that persons with ASD would show a lower accuracy for distinguishing forced smiles and use a different strategy from neurotypical groups.Forced smile is defined as intentional laughter and superficial smile as a reaction to funny expressions, and which does not depend on one's natural feelings.

３．研究の方法

1. Participants The sample consisted of 10 persons with ASD (mean chronological age of 21.3 ± 4.8 years) and 16 individuals with neurotypical development (mean chronological age of 22.4 ± 1.7 years). ２．Measures ① Definition of forced smiles: Each participant was asked to answer, "What is a forced smile?" ② Kikuchi's Scale of Social Skills (Kiss-18) (Kikuchi, 1988) ③ Distinction of a forced smile ④ Eye movementThe tasks were individually administered in a quiet room during one session lasting about an hour. ３．Ethical consideration The study was approved by the ethical review board of the author's affiliation.

４．研究成果

１．Definition of a forced smile Protocols of the ASD and the TD groups were classified into four laughter types: to smile forcibly, to express depending on the atmosphere of the place even though it may not be interesting, to be anxious about not letting relations with the other person worsen, and to present a good impression of oneself. ２．Distinction of forced smile Correct answers The study conducted a t-test of the correct scores, which indicated that the TD group scored significantly higher than the ASD group (t (24) = 2.7, p < .05). ３．Correlation of Kiss-18 and forced smile distinction scores Pearson product-moment correlation coefficient analysis between the Kiss-18 scores and correct forced smile distinction scores showed a positive correlation between the two variables in the TD group (r = .41, p < .05) but not in the ASD group (r = .62, n.s.). 2. Eye movement (intuitive mentalizing) ① The t-test for the length of visual fixation and fixation count for each AOI indicated that the TD group had a significantly higher length of visual fixation in the left eye than the ASD group (t (24) = 2.62, p < .05). ② Some of the subjects with ASD and TD showed differences in eye movements, even though they had comparable score points of Kiss-18 and distinction of the forced smile. A difference in eye movement between an ASD case (57 points on Kiss-18, 40 points on distinction scores) and a TD case (64 points on Kiss-18, 40 points on distinction scores) indicating the same degree was observed. In terms of length of visual fixation, a TD case was longer than ASD for the AOIs of the right eye, left eye, nose, and mouth. In terms of fixation count, the ASD case was higher than the TD for the AOIs of the left eye, nose, and mouth.

Both ASD and TD groups provided the same definition of a forced smile, coinciding with the definition of a previous study (Oshimi, T., 1999). Therefore, even if a difference was observed in the distinction of forced smiles, it did not occur in terms of the definition but in the accuracy of the distinction. The TD group tended to distinguish forced smiles correctly, indicating that they have more effective skills for maintaining smooth social relations. A positive correlation was shown between social skills scores and the correct distinction of forced smiles scores in the TD group. However, no correlation was found in the ASD group. The ability to distinguish forced smiles may vary depending on an individual's social skills. Therefore, the skills related to the distinction of forced smiles

need to be examined. This study considered the reasons for forced smile distinction as part of the propositional mentalizing of the forced smile. The TD group judged the balance between each part of the face, the overall expression and general impression, and the sense of incongruity. Regarding the difference between laughter and forced smiles, Duchenne (1990) indicated that a smile is produced by the joint action of two facial muscles. Ekman and Friesen (1982) reported that the common elements in the facial expressions of all such positive experiences are the actions of two muscles. They explained the zygomatic major pulling the lip corner upward toward the cheekbone and the orbicularis oculi raising the cheek and gathering the skin inward from around the eye socket. In addition, Ekman, Hager, and Friesen (1981) revealed that deliberately made facial expressions, such as false smiles, would require more cortical involvement, and thereby be more likely to show asymmetry because of cerebral specialization, compared with uncontrolled, spontaneous, and felt emotional expressions. In the TD group, the reasons for distinction between forced and natural smile were based on the whole face, which may explain the accuracy of their distinction. Meanwhile, in the ASD group, the reason involved only one part of the face which accounted for approximately half, and as for propositional mentalizing that was how a forced smile was distinguished. The concept of "weak central coherence" (Happe, F., & Frith, U., 2006) implies that persons with ASD have a perceptual bias for local not global stimulus features. This upper limit may have led to a lower accuracy of distinction. Eye movement as an intuitive mentalizing was analyzed for the length of visual fixation and fixation count for each AOI. The TD group reported a significantly higher length of visual fixation in the left eye, compared with the ASD group. Even if the distinction of the forced smile is the same, the strategy for distinction may differ. A difference in eye movement, length of visual fixation, and fixation count between an ASD case and a TD case who recorded the same Kiss-18 and distinction scores was found (Table 2). However, the study could not delve into the meaning of this difference in terms of ASD. The results suggest the use of an atypical strategy in the ASD group. Further, differences in eye movement, length of visual fixation, and fixation count between the low- and high-score cases in the ASD group were observed (Table 3). Therefore, a variety of aspects exist in the ASD group. Kamio (2004) indicated that the difficulty in recognizing facial expressions in ASD changes with the development of persons with ASD; they may not develop a strategy during typical development, and instead a unique atypical strategy is developed. In the theory of mind task, persons with ASD use verbal propositional mentalizing and not intuitive mentalizing (Beppu, S., & Nomura, K., 2005). A similar phenomenon may have occurred in the present task. It may be recognized that intuitive attention is turned to the whole face in persons with TD; however, people with ASD exhibit reduced attention and sense of incongruity. Moreover, this study suffered the limitation of a small sample size. Therefore, further examination is required to determine these differences. The so-called Duchenne smile, in which the muscles around the eye are activated, in addition to the muscle that pulls the lip corners up (Ekman, P., Davidson, R.J., Friesen, W.V., 1990) is not universal but rather limited to certain cultures. Studies on smile perception have been restricted to Western countries, which is suggestive of a display rule that would need to be acquired during socialization in different cultures. Thus, future work is needed to elucidate the sociable function and perception of laughter/smiles in Eastern countries, which may have specific cultures related to laughter (Li, S., & Shibuya, S., 2011). Further research is required to examine forced smile in the Japanese culture

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