



Research article

The social smile in infants during the COVID-19 pandemic

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ABSTRACT

The emergency created by Coronavirus disease 2019 (COVID-19) has inevitably changed human normal social and relational habits. The use of personal protective equipment, like surgical masks, by healthcare workers has been recommended to prevent human-to-human transmission of the novel coronavirus infection. However, the use of these masks could cause slight to considerable and reproducible changes in the infant's attitude towards the operator and health taker during routine clinical assessments.

We reported a brief report on the impact of to the use of the surgical masks on the affective behaviour in 40 infants of age 2–9 months (study group) by using a scale to assess pain and distress among pediatric patients, the Face, Legs, Activity Cry and Consolability Scale (FLACC), and in 40 infants with the same ages and characteristics assessed before the COVID-19 pandemic onset (control group).

Thirty-seven of the 40 infants in the study group had some signs of discomfort and appeared irritable and less prone to be engaged by the examiner with a different pattern of responses related to age with better responses for younger infants. These infants reported higher significant scores ($p < 0.001$) in the FLACC scale than those assessed before the COVID-19 onset.

Infants appear to react negatively to the use of the surgical mask by the health operator.

A different way to assess paediatric patients in early infancy with longitudinal studies should be proposed.

1. Introduction

The pandemic caused by Coronavirus disease 2019 (COVID-19) (World Health Organization, 2019), has imposed extensive measures to reduce the transmission, including social distance and personal protective equipment (PPE) like as face masks that are now commonly used by the population and mainly by health workers (Ibrahim et al., 2020). In the health sector the approach to the patient underwent a profound change and this could also influence the doctor-patient relationship especially in pediatric patients.

Generally, infants are examined in between feeds, when they are awake and quiet and are generally easily engaged by the examiners' voice and facial expression and there is rarely need to postpone assessments or for parents intervention to elicit the social smile; it represents an important milestone in the infant's psychological development (Ruvolo et al., 2015) for the first development of intentional communication, as an early social communicative skill in typically developing children,

necessary to start and establish the parent-infant social relationship (Lee et al., 2017) and for the development of the language.

In children, the use of the surgical mask could add an emotional distancing to the physical one as it is more difficult to create a therapeutic alliance, which is fundamental for the complete success of the medical visit. In fact, at the time we had to wear face masks during routine outpatient visits, we noticed a change in the infant's attitude towards us with an increasing number of examinations that had to be interrupted and repeated with some difficulties to elicit the social smile. This prompted to systematically record infants' reactions during follow-up clinical assessments to establish the possible impact of the new procedures.

2. Materials and methods

From the beginning of April 2020 to December 2020, 40 infants of age 2–9 months (study group) with no history of neurological impairments,

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were randomly examined during a routine pediatric follow-up assessment; twenty-two (12 males and 10 females) infants were assessed between 2 and 5 months, and the other 18 (11 males and 7 females) were assessed between 6 and 9 months. In our Institution, all the babies dismissed by the nursery perform a general clinical evaluation including a structured neurological assessment using our routine procedures (Cioni and Mercuri, 2007). It consists of a simple neurological examination for the early diagnosis of neurological impairment for infants from 2 to 24 months, including several aspects of neurological functions, as cranial nerve assessment, posture, movements, tone, reflexes, and behaviour with a total length of no more than 10 min. All the infants included in the present study performed this neurological examination; all the health operators had to wear a surgical mask during the assessments according to the national health recommendation related to COVID-19 pandemia.

During the clinical assessment the Face, Legs, Activity Cry and Consolability (FLACC) scale was routinely used to measure objectively the discomfort during the assessment (Merkel et al., 1997); this tool comprises five categories (face, legs, activity, cry, and consolability), and a score of 0–2 is given for each category depending on the observed pain/distress behaviors. The total score ranges from 0–10, where 0 indicates no pain/distress at all and 10 indicates the most extreme pain/distress. It was developed as a tool to assess pain in children aged two months to seven years, and it is considered one of the most well-known and widely recommended scale to assess pain and distress among pediatric patients (American Academy of Pediatrics 2001).

A further group of 40 infants with no history of neurological impairments, assessed in the 2019 before the COVID-19 pandemia onset, was randomly used as control group and performed the same assessments in the same conditions of the study group, as the clinical assessments (neurological assessment and FLACC scale) were routinely performed in our Institution even before the pandemic by COVID-19; twenty of them were assessed between 2–5 months (10 males and 10 females) and the other 20 between 6–9 months (10 males and 10 females).

The assessments were performed by two authors (DMR and FS) with a large experience in the field of infant's examination in both control and study group.

All the 80 infants included in the present study (40 in the study group and 40 in the control group) were video recorded, as part of our clinical routine, with a written parent consent, and this allowed to review their reactions during the assessments. All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Fondazione Policlinico A. Gemelli-IRCCS Ethics Committee (ID 3354).

2.1. Statistical analysis

Statistical analysis was performed using the SPSS v.19.0 software (SPSS Inc.; Chicago, IL). ManneWhitney non-parametric test for independent samples was used to compare the FLACC scores of the study group and control group. The statistical significance was set at $p < 0.05$.

3. Results

Thirty-seven of the 40 infants in the study group had some signs of discomfort and appeared irritable and less prone to be engaged by the examiner, with a different pattern of responses related to age. In 19/22 infants assessed between 2–5 months, we noticed an initial difficulty in obtaining full visual attention, with frequent gaze aversion reactions (Figure 1a) and initial irritability. After a few minutes, the infants appeared to get used to the examiner and to react to his/her voice; it was possible to elicit the social smile and to complete the assessments (Figure 1a,b). In 3 infants the assessments were easily completed and no adverse reaction to the surgical mask was reported, reporting the social smile and a continuous adequate behavioral state during the assessment.



Figure 1. a–b Social smile in a 3 months infant. a). infant upset for the interaction with an operator with a surgical mask. b). after a few minutes, the infants react to the voice of the operator and it is possible to elicit the social smile and to complete the assessment.

All the infants assessed between 6–9 months in the study group had increased irritability and often inconsolable crying and in some cases expressions of fear with no obvious reaction to the examiner's attempt to console, talking to them or using the procedures (patting, cuddling) successfully used in the pre-COVID-19 routine (Figure 2a,b). In 14/18 infants (78%) there was the need for parental intervention and in 10 cases (56%) the assessment had to be postponed.

In the control group, irritability was reported in no-one of the infants assessed between 2–5 months and in 2 infants assessed between 6–9 months. Infants in the study group reported higher significant scores ($p < 0.001$) in the FLACC scale (total scores and categories) than those of the control group (Table 1).

4. Discussion

Social smile in infants is an important milestone (Ruvolo et al., 2015) for the development of intentional and social communication (Lee et al., 2017) and for the development of the social motivation and social language. Several studies base on study of brain functional imaging confirmed the role of smile in children for the social relationship. The social restriction related to COVID 19 have modified some social habits including clinical assessment also in children in early stage of life.

Our preliminary data suggest that infants appear to react negatively to the use of the surgical mask by the health operator. The interaction was more difficult than pre-COVID-19 pandemia, as 2 infants only in the control group presented irritability as reported by significant lower scores in the FLACC scale than the infants in the study group both in younger and in older infants. The mask covering mouth and nose reduces the contrast between the different parts of the examiner's face, reducing the possibility to maintain visual attention that in the first year is mainly based on sensitivity to contrast. The infant's response is however different according to their age.

While younger infants, after an initial difficulty in engaging with the examiner, established visual contact reacting to the examiners' voice, after the age of 6 months the reactions were more complex probably as the result of different factors. First, after 6 months, there is increased awareness of the difference between familial and non-familial faces and this is probably amplified by the use of the mask. Wearing a mask, covering the examiner's mouth, is also a confounding factor in the interaction and in the process of language acquisition (Cashon, 2011; Teinonen et al., 2008; Ichikawa et al., 2014) in which the observation of the mouth plays an important role.



Figure 2. a–b Social smile in a 8 months infant. a). infant upset for the interaction with an operator with a surgical mask. b). after a few minutes, no obvious reaction to the examiner's attempt to console the infant (voice of the operator, patting, cuddling) is observed.

Table 1. FLACC scale results in study and control group.

FLACC scale	Total score Median (min-max)	Face Median (min-max)	Legs Median (min-max)	Activity Median (min-max)	Cry Median (min-max)	Consolability Median (min-max)
2-5 months						
Study group	3 (0–10)*	1 (0–2)*	0.7 (0–2)*	0.5 (0–2)*	0.6 (0–2)*	0.2 (0–2)*
Control group	0.2 (0–1)	0.1 (0–1)	0.1 (0–1)	0.1 (0–1)	0	0
6-9 months						
Study group	6.7 (2–10)°	1.7 (1–2)°	1.2 (0–2)°	1.2 (0–2)°	1.4 (0–2)°	1.3 (0–2)°
Control group	1.2 (0–5)	0.3 (0–1)	0.1 (0–1)	0.3 (0–1)	0.2 (0–1)	0.2 (0–1)

*P < 0.01 Study group Vs Control group at 2–5 months.

°P < 0.01 Study group Vs Control group at 6–9 months.



Figure 3. Cover mask with a static smile.

Furthermore, the mask also reduces the ability to recognize more subtle facial expressions (Ichikawa et al., 2014; Calvo et al., 2014) and the recognition of a smiling face, that are important for the development of the ability to react with the so called social smile (Ruvolo et al., 2015) that contribute to the development of paralinguistic communication skills. This appears to be relevant also based on the involvement of the mirror neuron system, present since the first months of age (Paracampo et al., 2017; Braadbaart et al., 2014). Mirror neuron system is active when looking to faces communicating emotions and has been hypothesized its activation is a basis for empathy, per instance for a smiling face (Paracampo et al., 2017; Braadbaart et al., 2014). This system, when activated, may facilitate mirroring of the facial expressions and this imitation is in fact a social skill, contributing to the synchronization and empathy with others, possibly already in infant's dyadic interactions (Paracampo et al., 2017; Braadbaart et al., 2014). When masks are used, infants can only look to the top half of the face to recognize the smile of the operator and the eyes alone may not sufficient to trigger mirroring and imitation of the facial expressions.

5. Conclusions

In conclusions our preliminary study shows that infants appear to react negatively to the use of the surgical mask by the health operator. As it is likely that the need to continue social distancing and to wear protection will continue for several months after the peak of infections, possible alternative strategies should be proposed in an attempt to reduce the impact of these devices, increasing the frequency of optimal infant behavioral states during pediatric clinical assessments.

To promote empathy between the infant and the operator, a cover masks with contrasting patterns or a static smile (Figure 3) could be proposed; it may facilitate, especially in the first months, sustained visual attention and reassure infants, even if it could not be enough, as infants react well to dynamic facial expressions related to the emotional appropriate voice. A human speech which does not seem to come from a

moving mouth, may seem unnatural to the infant that look to a face as a source of emotion communication (Simpson et al., 2014) and can recognize more subtle happy expression when presented dynamically (Ichikawa et al., 2014).

Wearing a face shields would be a more appealing option, but not practicable as it is an additional protection by healthcare workers and not considered sufficient alone to guarantee appropriate quality and safety for patients and healthcare workers. Recently, transparent surgical masks have been proposed but in most country, they are not yet recognized as PPE to use for health workers. Feasibility and advantages from these approaches should be studied prospectively, and preliminary evaluations with a preferential looking approach may be helpful. Physical distancing and the use of PPE, which have now become mandatory with strangers, is undoubtedly problematic for adults and psychological reactions to pandemics include maladaptive behaviors, emotional distress and defensive responses. However, it is even more problematic for children who are spontaneously inclined to express their emotions, often seeking contact.

Therefore is important to follow up these children in order to monitor the development of adequate social communication both at low and high risk for neurodevelopmental disabilities.

Declarations

Author contribution statement

Domenico M. Romeo, Eugenio Mercuri: Conceived and designed the experiments; Wrote the paper.

Massimo Apicella: Performed the experiments; Contributed reagents, materials, analysis tools or data.

Giuseppina Leo: Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data.

Maria Mallardi: Analyzed and interpreted the data.

Francesca Sini, Chiara Velli: Performed the experiments.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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