

UNIVERSITA' DEGLI STUDI DI VERONA

DEPARTMENT OF HUMAN SCIENCES

GRADUATE SCHOOL OF HUMANISTIC STUDIES

DOCTORAL PROGRAM IN HUMAN SCIENCES

Cycle XXIX

Infant massage and development of early intersubjectivity

S.S.D. M-PSI/04

Coordinator: Prof.ssa Manuela Lavelli

Signature _____

Tutor: Prof.ssa Manuela Lavelli

Signature _____

Doctoral Student: Dott.ssa Elena Anderloni

Signature _____

Acknowledgments

It is a great pleasure for me to thank and acknowledge everyone who helped me complete this work.

This dissertation would not have been possible without my supervisor Prof. Manuela Lavelli, who guided and supported me in every phase of the doctoral program.

I would like to express my gratitude to my Italian colleagues at Verona University and at SLD Lab, for time and friendship.

I am truly indebted and thankful to all the mothers and infants participating in this research, who gave me confidence and believed in the implementation of this project.

I am thankful to Prof. Lynne Murray, who gave me the possibility to work for three months in her Lab at Reading University and to all my colleagues that I met there.

Last but not least, I would like to thank the most important part of my life, my family and friends.

Table of contents

Abstract	7
1. Introduction	
1.1 The present project	10
1.2 Main aim	10
1.3 Specific aims	11
1.3 Dissertation structure	12
2. Review: Maternal tactile contact, kangaroo care and infant massage	
2.1 Introduction	13
2.2 Physical contact in mother-infant interactions: effects on self-regulation and dyadic co-regulation	15
2.3 Touch and culture	17
2.4 The skin-to-skin (or Kangaroo Care) practice: the effects on dyads with preterm and full term infants	19
2.4.1 Effects on infant's self-regulation	20
2.4.2 Effects on physiological and relational aspects of mother-infant co-regulation	21
2.5 Self-regulation and co-regulation in infant massage	24
2.5.1 Effects on infant's self regulation	24
2.5.2 Effects on mother-infant co-regulation on physiological and relational aspects	26
2.6 References	28
3. Study 1: Effects of infant massage on maternal touch	
Abstract	40
1 Introduction	41
2 Method	45
3 Results	51
4 Discussion	57
5 References	59

4. Study 2: Effects of infant massage on mother-infant interaction in the first months of life	
Abstract	65
1 Introduction	66
2 Method	71
3 Results	74
4 Discussion	76
5 References	78
5. Study 3: Effects of infant massage on 2-month-old infants' response to the Still-Face	92
Abstract	92
1 Introduction	93
2 Method	97
3 Results	102
4 Discussion	106
5 References	108
6. Conclusions	114

Ph.D. candidate: Elena Anderloni

Infant massage and development of early intersubjectivity

Abstract

This dissertation presents three empirical studies that have been carried out to investigate the impact of infant massage on the development of mother-infant communication in the first three months of life.

It is well known that mother-infant communication is a dynamic process in which both mother and infant influence each other. Especially from the second month of life –that is marked by the acquisition of the exogenous control– along with the presence of social smiling, head control, and a more active alert state, reciprocal interaction between mother and infant begins. Furthermore, the infant's early sense of self as an agent, and the infant's first social knowledge develop with his/her understanding of the connection between his/her own actions and caregiver's social responses; this helps the infants to develop sense of efficacy in their social exchanges and expectations toward the others' social behaviors.

Especially during the first months of life, touch is a fundamental component of mother-infant interaction: it is an influential channel of communication between infant and caregiver, both for communicating emotional state and developing the attachment relationship. In particular, it has been shown that infant massage has several benefits both on infant's development and on mother-infant interaction, especially in case of preterm birth and in presence of maternal depression. Research on benefits of infant massage in mother-infant relationship in typical population, that is, in non-clinical and not at-risk population are still scarce.

42 mothers and their infants participated in the research project. 22 mother-infant dyads were recruited and randomly assigned to a Target Group and 20 dyads to a Control Group. At 1 month, mother-infant dyads were videotaped (5 min) during spontaneous interaction in a naturally occurring context in their homes. From 5 to 9 weeks, dyads in the Target group were involved in a 5-week-massage training (IAIM program)

conducted by a certified IAIM trainer. At 2 months mother-infant dyads were videotaped during interaction in the Still-Face experimental procedure in the Lab at University. Finally, at 3 months, mother-infant dyads were videotaped (5 min) during spontaneous interaction in a naturally occurring context in their homes.

The first study aimed to analyze whether the qualitative (types) and quantitative (duration) aspects of maternal touch addressed to the infant during spontaneous interaction change -and how- after the massage training. Videotaped mother-infant interactions were analyzed using the Ordinalized Maternal Touch Scale (Beebe et al., 2010). The results showed that at 3 months the overall quantity of touch addressed to the infant decreased significantly only in the Control Group; even if mothers could use less touch due to a more emotional competence of infants, mothers who participated at the infant massage program demonstrated to give great importance to the touch as a communicative modality. Furthermore, Affectionate Touch, that is strictly related to the development of a secure attachment, decreased in both groups at 3 months, but it remained significantly higher in the Target Group. Playful Touch, that is used by mothers to maintain their infant's attention, increased in both groups but it was significantly higher in mothers who used infant massage in their everyday routine.

These results suggest that infant massage could be a modality to improve mother-infant interaction through the specific messages that are conveyed by maternal touch.

The second study aimed to assess whether mother-infant dyads engaged in the infant massage training show any qualitative change in their spontaneous interaction (except for changes due to the increased infant's age) at 3 months. Videotaped mother-infant face-to-face interaction were analyzed using Lavelli and Fogel (2013) coding scheme. Results showed a significant increase in maternal Stimulating behavior in the Target Group, and more time spent gazing at mother and Cooing behavior in infants in the Target Group.

These behaviors are indices of a more active interaction between mothers and infants that experimented infant massage in their everyday routine.

The third study aimed to investigate whether the practice of infant massage promotes infants' social expectations for their mothers' behavior, i.e., whether infants in the target group show more social expectations for their mothers' behavior than their peers in the

control group. Dyads participated in an experimental paradigm, the Still-Face, in which mothers, after a couple of minutes of normal face-to-face interaction with their infants, have to stop to interact with their infants but still looking at them, for one minute and a half; after this period, mother and infant can resume the normal interaction. Normally, during the Still-Face phase, infants show a decrease in positive affect and an increase in negative affect, with a carryover effect in the reunion phase.

In our sample, infants in both group behaved similarly, but with some differences: during the Still-Face phase infants in both groups increased their active behavior in order to resume their mother's attention, during the reunion phase, infant in the Target Group lowered their Negative affect at the level of the initial interaction, while in the Control Group the infants' negative affect remained significantly higher than in the initial phase. With regard to infant Social Monitoring, after a general decrease during the Still-Face phase, only in the Target Group increased in the reunion phase: this indicates that infants who experimented infant massage spent more time looking at the mother face after a frustrating situation. However, Positive Monitoring in infants in the Target Group did not return at the initial level.

These results suggest that infants who received infant massage are more active in attempt to resume interaction with their mother when the emotional contingency is violated. Furthermore, they demonstrate to have a less negative carryover effect during the reunion phase, showing a better ability to participate again in the interaction after a frustrating episode.

In the whole, the results of the three studies suggest that the infant massage experience in the first month of life could be a modality to enhance mother-infant interaction also in non-clinical and not at-risk population.

1. Introduction

1.1 The present project

This doctoral dissertation develops from the elaboration and realization of a research project that took place from January 1st, 2014, to December 31st, 2016, in the setting of the Doctoral Program in Human Sciences, XXIX cycle, at University of Verona.

My personal interest for the main topic of the project, infant massage in the development of primary intersubjectivity, was easily integrated and developed within the activities of the “SLD Lab” directed by Professor Manuela Lavelli, meeting two main research fields of the group: developmental changes in early mother-infant communication, topic addressed in important international studies by Professor Lavelli in collaboration with other significant authors, and maternal tactile and motor stimulation of the infant, analyzed from a cross-cultural point of view, always with international collaborations.

Following the research plan, I started a personal training that led me to become a IAIM (International Association of Infant Massage) certified trainer; this allowed me to personally follow the mother-infant dyads that participated in the project in all the different phases.

During the PhD years, I spent a period of 3 months at the University of Reading, UK, in the Winnicott Research Institute, founded and directed by Professor Lynne Murray. During this period I expanded my knowledge on relationship aspects, particularly regarding “touch” between mother and infant during the first weeks of life, with possible future comparisons in the ethnology and neuroscience fields.

1.2 Main aim

The main aim of this project was to explore the impact of infant massage on mother-infant interaction in the first six months of the infant's life, in non-clinical population, at different levels.

From the very first moments of life, infants are engaged with their mothers, even if through simple gazing at her face, in a phase of ‘mutual attentiveness’ (Lavelli & Fogel, 2013). At 2 months, the acquisition of exogenous control (Emde & Buchsman, 1989;

Emde, Gaensbauer & Harmon, 1976), the onset of social smiling during interaction (Spitz, 1965), the appearance of prespeech movements and cooing (Trevarthen, 1979), along with a postural head control, longer maintenance of visual attention and more time spent in an active alert state, mark the beginning of a more reciprocal interaction between infant and caregiver.

Literature documents that infant massage has several benefits on infant's physiology and mother infant-interaction. It has been demonstrated that infant massage is a powerful way to regulate circadian rhythms (Goldstein Ferber, Laudon, Kuint, Weller, & Zisapel, 2002), promoting the quality of sleep in born at term infants (Scafidi et al., 1990; Xua et al., 2004), and to promote early growth and development in preterm infants, enhancing a greater weight and length increasing and a faster discharge from the hospital (Field et al., 2004). Infant massage has been demonstrated to be a modality to improve mother-infant interaction, especially in case of prematurity, post-partum depression, HIV infected mothers, and teenager mothers (O'Higgins, Onozawa, Field, 2008).

To our purpose, we recruited 42 mother-infant dyads: 22 were assigned to a Target group, and 20 to a Control group. At 1 month mother-infant dyads were videotaped for 5 minutes during mother-infant spontaneous interaction in the naturally occurring context of their homes.

From 5 to 9 weeks, dyads in the Target group were involved in a 5-week-massage training (IAIM program).

At 2 months mother-infant dyads were videotaped during interaction in the Still-Face experimental procedure.

At 3 months, mother-infant dyads were videotaped for 5 minutes during mother-infant spontaneous interaction in the naturally occurring context of their homes.

At 6 months another videotaping of mother-infant interaction was conducted, along with an interview on the experience of infant massage with mothers in the Target group.

1.3 Specific aims

The present project was guided by different specific aims:

1. To assess whether the qualitative and quantitative aspects of maternal touch addressed to the infant during spontaneous interaction change – and how – after the massage training, compared to a control group.
2. To analyze whether mother-infant dyads engaged in infant massage training show

any qualitative change in their spontaneous interaction (except for changes due to the increased infant's age) at short and medium term after the acquisition of this practice, compared to a control group;

3. To investigate whether the practice of infant massage promotes infants' developing social expectations for their mothers' behavior, i.e., whether infants who received infant massage show more social expectations for their mothers' behavior and more abilities to copy with the Still-Face than their peers in the control group.
4. To investigate whether the practice of infant massage enhances maternal mind-mindedness (Meins et al., 2013), i.e., whether mothers in the target group develop more propensity to "treat their babies as persons with a mind" than mothers in the control group.

1.4 Dissertation Structure

The present dissertation begins with a review of the international literature concerning the impact of maternal touch on infant's physiology and mother-infant interaction (Chapter 2): effects of maternal touch in the first months of life, in naturalistic or experimental contexts; cultural variability in maternal touch and effects on infant's development; benefits of skin-to-skin contact on infant and mother-infant co-regulation; effects of infant massage on infant and mother-infant interaction.

Chapter 3 illustrates Study 1, that investigated whether there are changes in maternal touch during spontaneous mother-infant interaction after the infant massage experience, in terms of quantity and/or quality of touch.

Chapter 4 illustrates Study 2. This study investigated the impact of infant massage on mother-infant interaction at 3 months.

Chapter 5 illustrates Study 3, that utilized the Still-Face paradigm to deepen the possible impact of infant massage on infant early social expectations when maternal communication and contingency are interrupted.

In Chapter 6 general conclusions are presented.

2. Review: Maternal Tactile contact, Kangaroo Care and Infant Massage

1. Introduction

Various studies conducted on non-human mammals revealed that maternal physical contact regulates the infant's physiological reactivity to stress and produces a long-lasting effect on the organization of stress reactivity (Hofer, 1995; Laviola & Terranova, 1998; Meaney, 2001); furthermore, the offering of tactile contact during maternal proximity deprivation periods attenuates the infant's stress response (Weller & Feldman, 2003). Throughout the last couple of decades, this result was also confirmed for the human species in both studies that used the experimental Still-Face paradigm (Tronick, Als, Adamson, Wise, & Brazelton, 1978) to simulate the temporary maternal unavailability (Feldman, Singer & Zagoory, 2010; Jean & Stack, 2008; Stack & Muir, 1992), and in studies that examined the effects of Kangaroo Care (skin-to-skin contact, e.g., Feldman & Eidelman, 2003; Feldman, Weller, Sirota, & Eidelman, 2002) or the practice of infant massage therapy (e.g., Field & Diego, 2008; Hernandez-Reif, Diego, & Field, 2007), on the development of preterm infants. Premature infants have been particularly studied as they are placed in thermic cradles immediately after birth which deprives them of experiencing physical contact with the mother for a post-natal period that is more or less prolonged.

Studies that focused on physical contact and contact stimulation in caregiver-infant relationship demonstrated that, additionally to benefits of maternal contact on the development of infant's self-regulation, the sense of touch is a powerful communication and emotional self-regulation channel (Hertenstein, 2002; Moszkovswi & Stack, 2007), and that infant massage can improve the processes of co-regulation of the dyad (Cullen, Field, Escalona, & Hartshorn, 2000) particularly in cases where the interaction is compromised by maternal postnatal depression (Glover, Onozawa, & Hodgkinson, 2002). These results however aren't always confirmed, and for what concerns the effects of infant massage on dyadic co-regulation and the development of mother-infant relationships, they are sometimes contrasting (Bennett, Underdown, & Barlow, 2013; Underdown, Barlow, & Stewart-Brown, 2010).

The present review seeks to analyze the roles and effects of maternal physical contact on infant's self-regulation and dyadic co-regulation during the first semester after birth, in both scenarios in which physical contact is spontaneous and in those in which it's offered to an infant with typical development or an at-risk infant, through specific practices such as the Kangaroo Care (skin-to-skin contact) or infant massage. As, from previous studies it appears that the mere maternal contact is not always enough to produce positive effects on self-regulation and dyadic co-regulation, specific attention is paid to both the factors that are considered to be crucial in order for the physical contact to have positive effects on infant's development and mother (caregiver)-infant relationship, and the issues that emerged from the controversial results.

The approach adapted in the present review is in line with the Infant Research perspective (Beebe & Lachman, 2002, 2014) that adopts a systemic model to explain the intersubjective dynamic between the caregiver and the infant. In this viewpoint, mother-infant communication is conceptualized as a dynamic bidirectional and multimodal system that generates from the interaction of self-regulation and co-regulation processes (Beebe, Rustin, Sorter, & Knoblauch, 2005; Fogel, 1993) starting from the neonatal period (Lavelli & Fogel, 2005, 2013). Specifically, tactile communication is considered in its dynamic nature, in which the stimulus' properties interact with the mother-infant relationship framework (Field, 2002; Hertenstein, 2002). The first part of the review will consider the effects of physical contact in the interaction of dyads with typical development observed in experimental settings, and the ones with an at-risk development observed in naturalistic settings. The contemplation of contact and tactile stimulation behaviors in non-western cultures will allow to highlight the universality and simultaneously the cultural variability of the quantity and quality of maternal touch directed towards the infant from the first days after birth.

The focus of attention will be directed on the Kangaroo Care and infant massage practices, which in the last couple of decades have been reintroduced in western cultures and are now widely spreading, to examine the effects on infant self-regulation and the co-regulation processes in both dyads with typical development and dyads that are at-risk due to premature birth of the infant and/or maternal psychological or social disorders. Lastly, the final considerations will discuss the clinical implications of the results, and those regarding the future developments of research in this field.

2. Physical contact in mother-infant interactions: effects on self-regulation and dyadic co-regulation

Maternal touch is a fundamental communication channel in the mother-infant relationship, especially as a mean to impart and regulate emotions (Hertenstein & Campos, 2001): but it's the quality of the touch that acts as an emotional regulator, not its presence or absence (Hertenstein, 2002; Jean & Stack, 2009; Moreno et al, 2006; Stack & Muir, 1992, Stack, 2010). As reported by Moreno (2006) and Stack & Jean (2011) for example, mothers often use playful contact to make their 6-months old infants smile, while they use a nurturing and tender touch to calm them down. Various empirical evidences in this regard underlined the effects of physical contact in infant self-regulation and dyadic co-regulation using experimental paradigms, particularly the Still-Face Paradigm (Tronick, 1978). Specifically, a study conducted by Jean & Stack (2009) observed how the type of touch used by the mother changes in the attempt to generate different kinds of emotions during the various Still-Face phases, especially during the Normal Period (that precedes the still-face episode) and the Reunion (that follows the still-face phase). Mothers mainly used a "nurturing touch", characterized by slow, calming movements with the purpose of showing affection or regulating negative emotions, and an "attention-getting touch" to get the infant's attention. 40 mothers participated in the study with their 5-and-a-half-month old infants, and one of the main goal was to verify whether the mothers mainly used an attention-getting touch during the Normal Period and a nurturing touch during the Reunion phase; moreover, an increase in the nurturing touch was hypothesized in the event of the infant reaching high stress levels during the Still-Face phase. Both hypotheses were confirmed, proving both that the type of maternal touch used can induce different emotional states in the child, but also that the caregiver changes the type of touch depending on the level of stress displayed by the infant, emphasizing the regulatory role of maternal touch. The nurturing touch acquires, then, fundamental importance in mother-infant attachment: Ainsworth et al. (1978) and later studies (Bates et al., 1985, Leyendecker et al., 1997, Network, 1997, O'Connor et al., 1992), underlined how children of mothers that use a touch that is predominantly tender and affectionate, establish a secure attachment; on

the contrary, the lack of this type of touch leads to an insecure resistant attachment (Schneider-Rosen & Cicchetti, 1984).

The effects of physical contact during the experimental Still-Face procedure have also been analyzed for what concerns the physiological changes in both the mother and the infant (Feldman, Singer, & Zagoory, 2010). For this purpose, in a sample of 53 mothers, 33 were assigned to the Still-Face procedure, and 20 to the Still-Face+Touch procedure, which allowed physical contact during the still-face phase. The physiological indexes collected during various moments of the experimental procedure revealed a significant cortisol decrease in the infants that were in the SF+T group 20 minutes after the still face phase and after 15 minutes more. Furthermore, during the SF+T phase and the Reunion phase the infant's vagal tone showed a significant increase: these results suggest that maternal contact reduces stress-related physical indexes in infants during the simulated deprivation of emotional contingency. A crucial aspect examined in this study was the one concerning synchrony, meaning the frequency of the maternal tender touch when the mother and the infant are in eye-to-eye contact, and dyssynchrony, which is the frequency of maternal stimulating touch during the infant's gaze aversion, throughout the different phases of the experiment: the first kind was proven to be linked with a high vagal tone frequency in the infant during the phase of free-play, while the second was found to be linked with high levels of cortisol in the mother for the majority of the experiment in addition to a low vagal tone in the infant during free-play. These results highlight the importance of a maternal style that is sensitive in organizing the infant's physiological systems, in addition to underlining the negative implications of maternal intrusiveness (Carter & Anher, 2005) on the child's development.

The type of touch used by mothers during the interaction with their preterm baby seems to have important consequences on the infant's development. For example, a study (Weiss, Wilson, & Morrison, 2004) showed that children of mothers that used a more stimulating touch during a recording of a typical breast-feeding when the infant was 3 months old, developed more visual-motor skills at 1 year, as well as visual habituation when presented with an object, grabbing it and moving it from one hand to the other: a stimulating contact in fact, conductor of neuronal arousal, could be of help in generating new synaptic connections and in strengthening already existing ones. Furthermore, a stimulating touch could help orient and activate the infant, helping him keep a state of active vigil. On the contrary, children that received stimulating contacts

less frequently, less than 25% of total time of observation, had a higher risk of developing visual-motor problems. Infants that received contact more frequently, regardless of the type, had more advanced gross motor development, supporting previous studies that demonstrated that sensory enrichment through tact and other senso-motor interventions could have benefits on motor abilities (Parham & Mailloux, 1996; Schoemaker, Hijlema, & Kalverober, 1994).

Another type of touch used, the nurturing touch, seems to have contrasting effects on premature babies (Weiss, Wilson, Hertenstein, & Campos, 2000): the presence of this type of touch at 3 months seems to positively favor a secure attachment at 1 year only for infants with a higher weight and lower perinatal risk. In those with lower weight on the other hand, the nurturing touch seems to promote a less secure attachment: the explanation could lie in the higher susceptibility to overstimulation in frail infants, even to gentle and affectionate caresses, due to weakness of their nervous system.

The studies mentioned above mainly focused on western cultures, but literature highlights facts that support universal and cultural aspects of touch that are shared with non-western cultures, particularly the African one, with consequent repercussions on the child's development.

3. Touch and culture

As reported by Montagu (1971) the quality and quantity of touch given to an infant varies from culture to culture. A series of observations made in the Sixties provided an initial overlook of how the presence and the quality of tactile contact can affect child's development. For instance, in the Netsilik Eskimos that live in the Boothia peninsula, the newborn baby is tied on the mother's back in close skin-to-skin contact, while the infant's back is wrapped with a heavy fur coat that also repairs the mother from the cold; in this way, the "holding" of the infant on one's back guarantees a continuous cradling that facilitates sleep and a rhythmic accompaniment to caregiver's daily routines, ensuring a broad vision from different points of view (De Boer, 1969). It's hypothesized that the brilliant spatial competences of the Eskimos are due precisely to this way of having been carried during the first months after birth (Carpenter, 1955).

The children of eastern African Ganda experience a prolonged and constant psychical contact: first on the mother's back and then on hers or other people's laps,

where they receive tactile stimulations continuously. In her observations in this tribe, Ainsworth (1967) noticed an early motor development in these infants when comparing them to infants their age from western cultures, especially in assuming the upright position, the sitting down position and in walking.

Moreover, children from the Kung tribe in the Kalahari Desert (Southern Africa) are in physical contact with their mothers or caregivers around 75% of the time from when they are 3 to 6 months old (Tronick, 1985).

More recently, the detailed study of these topics highlighted how mother-infant contact, even if different from one cultural context to the other in quantity, frequency and type, remains a common element in all cultures (Keller, 2007). Particularly, the main differences between cultures are related to the motor stimulation (Bril & Sabatier, 1986; Keller et al., 2009; Keller, Yovsi, & Volker, 2002; Lamm, Keller, Yovsi, & Chaudary, 2008; Super & Harkness, 1996, cit. in Carra, Lavelli, & Keller, 2013).

Motor exercises are very common in Sub-Saharan traditional rural cultures, cultures where a parenting style that emphasizes physical contact with the infant and child is very endorsed, and in which can be found a subsistent economy, a low level of formal education and values that privilege cooperation between members based on roles: examples of these traditional cultures are the Kipsingis and the Kung Sang (Harkness & Super, 2001), the Gusii (Le Vine & Le Vine, 1963), the Wolof (Falladé, 1960) and the Bambora (Bril & Sabatier, 1986).

On the other hand, in Western urban cultures motor stimulation is not very valued; in the same way, values are different, more oriented on psychological autonomy and on individual development (Keller & Kartner, 2013). In these cultures, physical stimulation is practiced in the form of “touch”, which includes all the touching behaviors that the caregiver can exercise on the infant’s body from a distal position such as static touch, caressing, tickling, and shaking the infant (Jean, Stack, & Fogel, 2009).

A recent contribution studied another aspect of physical stimulation in the first three months of the infant in different cultures; this study (Carra, Lavelli, & Keller, 2013) compared cultural differences, continuity and changes in practices regarding physical contact in Italian mothers and mothers from Western Africa in an immigration setting. While Italian mothers gave more emphasis on physical touch, the immigrant mothers gave more importance to motor stimulation; additionally, they showed rhythmic behaviors, both motor and tactile, for a longer period of time compared to

Italian mothers.

The consequences of these parenting styles on the self-regulating skills and infant self-recognition have been widely analyzed in a study that compared three different cultures: Nso mother-infant dyads, Greek and Costarican (Keller, Yovsi, Boerke, Kartner, Jensen, & Papaligoura, 2004). The authors identified three parenting styles associated with different mother-infant contact manners that reflect just as many sociocultural orientations. The first one, the proximal parenting style, emphasizes physical contact and motor stimulation and can be associated with an interdependent sociocultural orientation that gives a broad space to the relationship and group dependency; the second one, the distal parenting style, privileges a face-to-face interaction style that is associated with an independent sociocultural orientation that promotes autonomy and separation; the third one is a combination of the other two, and promotes both autonomy and relationship.

Results proved that Nso children (whose mothers preferred a parenting style characterized by a lot of contact and physical stimulation) showed higher self-regulation compared to Costarican kids (whose mother preferred a face-to-face parenting style) which confirms that physical contact and stimulation are an important vehicle that allows the infant to self-regulate. The physical contact in spontaneous mother-infant interaction is not the only way through which a child is touched: particularly in Western Africa and in India a practice that is very common is infant massage therapy (Muscarella, 1996), that from the Seventies started being gradually reintroduces in western culture; nowadays the interest in this type of contact is increasing in both the research field and in daily practice.

4. The skin-to skin (or Kangaroo Care) practice: the effects on dyads with preterm and full term infants

The skin-to-skin contact practice started in Bogotá, Colombia, in the Seventies as a replacement to the cares offered by the incubator in the event of a preterm birth: the newborn, once stable, is placed on the mother's chest and warmed with her body heat. There are various skin-to-skin types of contact that differentiate from each other according to the time that passes from birth to the beginning of the real treatment: 1) *birth SSC*, when the newborn is placed on the mother's chest the very first minute after birth; b) *very early SSC*, that starts from 30 to 40 minutes after birth; c) *early SSC*, when

the infant in put in contact with the mother in the first hours after birth or in the time frame of the first day of birth.

There have been numerous studies on the skin-to-skin contact (also known as Kangaroo Care), infant self-regulation and dyadic co-regulation, that concentrated on both full-term babies, and especially on pre-term babies, that found various connections on the results and benefits obtained.

4.1 Effects on infant and mother's self-regulation

Normally, full term infants start a series of instinctive behaviors right after birth (such searching for the mother's breast) when they are given the opportunity to experience early skin-to-skin contact (Righard & Alade, 1990). Skin-to-skin contact, through sensory stimuli, is an important vehicle of vagal stimulation that in turn releases maternal oxytocin (Uvnas-Moberg, 1998; Winberg, 2005): oxytocin is very important in the first instants following birth as it facilitates maternal behaviors and a state of calm that reduces anxiety. A meta-analysis completed by Moore, Anderson, and Bergman (2007) has highlighted on this regard how mothers that had the opportunity to benefit from an early skin-to-skin contact had a higher success in breastfeeding from 1 to 4 months of the infants, and also had a more affectionate touch during the breastfeeding. It appears to be crucial then to promote and encourage this "sensitive moment" right after birth, so that the baby and the mother develop a mutual synchronized interaction. In the twentieth century, with the increase of the number of babies born in hospitals as opposed to at home, there has been a higher frequency of early separation between mothers and infants. Consequently, recently there has been a felt necessity to re-introduce skin-to-skin contact practices in the normal routine of neonatology wards.

For what concerns infant self-regulation benefits of skin-to-skin contact, the studies that have been conducted up until now have examined the effects starting from the first hours of life after birth. Kangaroo Care is hypothesized to be a medium that allows the infant to self-regulate, especially in the organization of sleep-wake cyclicity, and promotes a better cardio-respiratory and thermic stabilization as well as a higher glucose concentration in the blood (Feldman, Weller, Sirota, & Eidelman, 2002; Feldman, 2004; Hofer, 1995). In this regard, a study made by Ferber and Makoul (2004) examined the effects of skin-to-skin contact right after birth as well as its effects on neurobehavioral responses in full term infants. Right after birth the newborns were placed for 5 to 10 minutes on the mother's chest while the placenta was being expelled and the umbilical

chord cut. The effects of this type of contact revealed to be a very important contribution for what concerns the newborn's self-regulation, especially in the harmony of the motor system and sleep organization. The infants kept a calm sleep for a longer time compared to the ones in the control group; this exact self-regulating organization is very important for the first hours of life outside the uterus: sleep is in fact present (Feldman et al., 2002; Feldman & Eidelman, 2003; Feldman, 2004) for 70% to 80% of the time in newborns. The underlying hypothesis is that a newborn uses sleeps as a response to the stress of birth (Carrol, Denenberg, & Thoman, 1999): skin-to-skin contact improves, then, a correct adaptive response. A lower stress level, other than a diminution of crying in the newborns (Moore et al., 2007), seems to also influence the increase of flexor motor responses that have been analyzed by this study; the infants in fact, showed more flexing movements of the limbs as opposed to extension movements. This data is interesting in light of the findings that underlined how extension movements are expressions of pain (Ferber et al., 2004; Grunau, Holsti, Whitfield, & Ling, 1993). The regulation of the sleep-wake cycle also finds confirmation in the evidences that concern skin-to-skin contact in preterm babies (Feldman et al., 2002). Premature birth deprives the newborn of the benefits of maternal proximity and contact: for this reason, in the last years numerous studies have been made with the aim of restoring this early touch deprivation. In the Feldman et al. (2002) study, mothers offered their premature babies at least one hour of skin-to-skin contact for 14 consecutive days after birth. It was observed that the newborns, at their term week, displayed a better organization of their sleep-wake cycle compared to the control group. Not only: at 3 months, the infants had a higher threshold of tolerance of negative emotions and more efficient arousal modulation while attending to increasingly complex stimuli, measured through the Behavior Response Paradigm (BRP; Garcia-Coll et al., 1998). At 6 months the infants proved to have a longer duration of and shorter latencies to mother-infant shared attention; moreover, they sustained exploration in a toy for a longer time compared to the control group. These results are in line with numerous other studies that remarked how skin-to-skin contact is an important mean of self-regulation of the infant. For example, as reported by a study done by Gray, Watt, and Blass (2000), skin-to-skin contact is a strong analgesic: during normal hospital procedures, as the taking of a blood sample from the baby's heel, it was observed that infants that were in contact with their mothers cried 82% less and sneered 65% less

compared to infants that were in their cradle, and they also had a lower heart rate.

4.2 Effects on physiological and relational aspects of mother-infant co-regulation

The effects of skin-to-skin contacts on dyadic co-regulation between mother and child have been analyzed in a number of studies that explored both the relationship and the physiological aspects. In a recent study conducted by Neu et al. (2014), dyadic co-regulation was described as the progressive reduction of the cortisol levels in both the mother and the preterm baby: in particular, the presence of stressful situations seems to be a critical condition for the efficiency of skin-to-skin contact. In a study by Morelius, Theodorsson and Nelson (2005), 17 mother-infant dyads with premature infants were exposed to 4 Kangaroo Care sessions in Neonatal Intensive Care; salivary cortisol measures, heart rate, mood scale, and stress measured on a visual analog scale (VAS) were recorded and analyzed in both mothers and infants during the first skin-to-skin contact session, the first time that the baby was taken out of the incubator, and during the fourth session. Before starting the first SSC session, mothers had high cortisol levels, heart rate and VAS, values that significantly decreased during the skin-to-skin contact. Before the fourth session, mothers had lower stress indexes, probably due to the habituation of the procedure, but the cortisol levels and heart rate decreased further during the SSC session. The infants on the other hand had fluctuating levels of cortisol concentration, higher during the first SSC session compared to the fourth, probably due to an immature control of the hypothalamic-pituitary-adrenal system. Furthermore, the newborns included in the study were too small to have matured a daily cortisol rhythm. In non-stressful situations, it could be observed that the type of holding isn't critical for regulation. Specifically, a group of preterm babies was assigned to one hour of SSC per day for 8 weeks, while another group was assigned to a containment in a blanket on the mother's lap; a third group, the control group, didn't receive any indications regarding the type of holding. The results indicated a decrease of cortisol levels in both the mother and the infant during the holding phase, independently of the type of contact offered to the child.

Breastfeeding also seems to be affected positively by skin-to-skin contact; mothers of preterm babies that used this type of contact with their child had on average 4 more weeks of breastfeeding compared to those who used standard cares (Whitelaw, Heisterkamp, Sleath, Acolet, & Richards, 1988). SSC allows oxytocin release, which is

responsible for the production of the mother's milk (Blaymore Bier, Ferguson, Morales, Liebling, Oh, & Vohr, 1997). For what specifically concerns the relational aspects of dyadic co-regulation, a number of empirical evidences have demonstrated the positive effects of SSC on the mother-infant relationship. For example, Feldman, Eidelman, Sirota and Weller (2002)'s study involved 146 preterm babies (weighing between 530 and 1720 grams) divided into two groups: 73 of which (between the 31 and the 34th week) received a SSC for one hour per day for 14 consecutive days while the other 73 received the normal cares inside the incubator. At the 37th week of gestational age, the mothers of the experimental group had a better interaction with their infants in the Mother-Newborn Coding System, had fewer depression symptoms, more responses to the infant's signals and more touch as well as a less frequent gaze aversion from the infant and a higher state of active vigil. At 3 months, correct age, it was noted, with the Home Observation for the Measurement of the Environment, that both mothers and fathers were more involved and sensitive. At 6 months, the infants scored higher in the Psychomotor Developmental Index and in the Mental Developmental Index (Bailey- II), and had a better dyadic interaction.

A successive analysis on the same sample (Feldman, Sirota, & Wellwe, 2003), allowed to observe lower intrusiveness from parents from the experimental group and better family cohesion. These results are very important, as reported by Feldman (2002), considering that preterm birth increases the risk of developmental problems, specifically in motor and cognitive skills that are usually lower compared to term babies (Vohr, Garcia, & Coll, 1985; Vohr et al., 2000; Allin, Matsumoto, & Santhouse, 2001; Barrera, Rosenbaum, & Cunningham, 1987), as well as problems regarding the attention system, such as less time spent in an active sleep state (Holditch-Davis, 1990), fewer abilities in focused visual inspection (Ruff, 1986), and an immature visual habituation (McCall & Carringer, 1993); these characteristics noticeably influence mother-infant interaction as they impede correct dyadic tuning (Eckerman, Hsu, Molitor, Leung, & Goldstein, 1999; Malatesta, Grigorvey, Lamb, Albin, & Culver, 1986), with a consequent decrease of touch, gaze and vocalizations (Minde, Whitelaw, Brown, & Fitzhardinge, 1983). The lack of communication involvement with the infant also seems to impact the child's cognitive development (Beckwith & Parmelee, 1986; Lester, Boukydis, & Garcia-Coll, 1995) as well as accentuate the mother's levels of depression (Brooten, Gennaro, & Brown, 1998). Thus, the results on the effects of skin-to-skin contact described are very

significant in light of the co-regulation model explained by Beebe (2005): a higher internal organization in the child and superior abilities to self-regulate, increase the activity state of the infant which goes to positively affect mother-infant relationship, with higher maternal and paternal involvement.

Observations on dyadic co-regulation have been made, other than in natural settings like in the previous descriptions, particularly through the Still-Face paradigm (Tronick, 1978), highlighting early indicators of social expectations of one-month old infants towards their mothers, in those infants that experienced a prolonged skin-to-skin contact with the mother. As stated by Bigelow & Power (2012), the newborns that experienced skin-to-skin contact for 6 hours a day during their first week of birth and 2 hours per day during their first month of birth, exhibited a Still-Face effect through non-distress vocalization; at 3 months, furthermore, the infants in the target group displayed more vocalizations during the still-face phase compared to the control group which in turn seemed to reduce the vocalizations during this phase when compared to the interaction phases preceding and following it. According to the authors, the results obtained, that revealed a higher infant self-awareness and awareness of the mother, could derive from the fact that skin-to-skin contact promotes a state of quiet vigil in newborns that are, in this way, less involved in self-regulating their internal states and therefore more available to receive stimulation from the mother; the latter could manifest behaviors of affiliation and a positive mood due to higher oxytocin levels that are also developed through physical contact (Carter, 1998; Uvnas-Moberg, 2003), increasing in such way maternal sensitivity. Furthermore, mothers that are more sensitive to infant signals are involved in more frequent and more positive interactions and their children appear to be more emotionally responsive (Legerstee & Varghese, 2001). It's important to underline how sensitive and responsive behaviors from mothers during the initial interaction phase in the Still-Face Paradigm are predictors of more positive behaviors in infants during the still-face phase (Braungart-Rieker et al., 2001; Lowe et al., 2006; McQuaid et al., 2009; Tronick et al., 1982). In premature birth, a study conducted by Neu and Robinson (2010) demonstrated how skin-to-skin contact promotes better mother-infant co-regulation during the spontaneous interaction phases following the still-face: the 6-month old infants would in fact interact using more smiles and vocalizations; these skills underline how newborns in the Kangaroo Care group were more self-regulated compared to the other infants.

5. Self-regulation and co-regulation in infant massage

5.1. Effects on infant and mother self-regulation

Studies that focused on infant massage underlined the importance of this practice for infant (both preterm and term) self-regulation, and for dyadic co-regulation, particularly with depressed mothers. On a strictly physiological plane, it was observed how infant massage given by mothers promoted the readjusting of circadian cycles in normal term newborns (Goldstein Ferber, Laudon, Kuint, Weller, & Zisapel, 2002). A sample of 52 mother-infant dyads participated in the study, of which half were assigned to the control group, while the other half were involved in an infant massage training of 30 minutes before the infant would go to sleep, that lasted 14 days and started between the sixth and fourteenth day after birth. Urine secretions of sulfomelotinia-6, that allow to pinpoint the phase of the circadian clock of the infant at a certain time, were higher in the experimental group at 12 weeks. These results agree with other evidences that underlined how mother-infant tuning affects the development of activity rhythms in newborns (Penman, Meares, Baker, & Milgrom-Friedman, 1983). An important branch of studies that observe the effects of infant massage studies preterm babies focusing particularly on their weight gain. The first work that studied this effect was the one carried out by Field and colleagues (1986), which compared two groups of 20 preterm babies with an average age of 31 gestational weeks and 1280 grams in weight. Infant massage was practiced on one of the two medically stable groups 3 times a day for ten days. Results proved an increase of daily weight of 47% in the infants of the experimental group. Different repetitions of the study were made (Diego et.al, Dieter, Field); particularly, one made in 2002 (Ferber et al., 2005) added an element with interesting repercussions for the cost and benefit balance in hospital structures; experimental groups in this study were, in fact, two: in one, the massage was given by a professional, in the other it was given by the mother. In both groups, there was a significant gain in weight compared to the control group, indicating how positive effects could be produced by both specialized technicians and the mothers. This translated in a release from the hospital that occurred on average 4,5 days sooner (Vickers, 2004).

The debate that followed these discoveries tried to determine the causes of the rapid weight gain in the massaged infants. A possible answer is found in the considerations made by Field and colleagues (Field, Hernandez-Reif, Diego, Feijo, Vera, & Gil, 2004;

and Field, Diego, Reif, Deeds, & Figuereido, 2006), that focused on the amount of pressure exercised during the massage: normal term infants that were massaged with a moderate pressure showed more substantial weight gain as well as height, a calmer sleep, a higher score in Brazelton's orientation scale and a lower score in the depression and in the excitability scale when compared to infants that were massaged with a light pressure (Field et al., 2004). Similarly, preterm babies (with an average of 30 gestational weeks and 1292 grams of weight) that were massaged with a moderate pressure showed a greater weight gain as well a higher state of wellbeing detected from a less frequent increment in hiccups, movements, cry, active sleep and restlessness (Field et al., 2006; Hernandez- Reif, Diego, & Field, 2007). The process beneath the weight gain could be attributed to a higher vagal tone and gastric motility observed during and after the massage (Diego, Field, Hernandez, & Reif, 2005).

5.2 Effects of mother-infant co-regulation on physiological and relational aspects

The effects of this self-regulation seem to reflect positively on the mother-infant relationship, especially in the case of preterm babies and in mothers that displayed post-natal depression.

In the first case (Ferber et al., 2005), dyads in which newborns received infant massage showed, at 3 months of the infant, a greater reciprocity, measured with the Coding Interactive Behavior Manual (CIB: Feldman, 1998), while the mothers were less intrusive and more sensitive to their infant's needs.

In the second case (Onozawa, Glover, Adams, Modi, & Kumar, 2000), mothers that participated in the infant massage training, showed lower scores in the Edinburgh Postnatal Depression Scale (Cox, 1987) and an improvement in the mother-infant interaction, measured with the Global Rating Scale (Murray, 1996).

These results are in contrast with other researches that examined dyads with full term infants: as reported by a recent meta-analysis conducted by Bennet, Underdown and Bennet (2013), there were no significant differences in the interactions primarily measured with the Nursing Child Teaching Assessment Scale (NCATS: Konian-Griffin, 1988; Elliot, 2002) and the Global Rating Scales (Murray, 1996). Only one study (Lee, 2006) that wasn't taken into account in the meta-analysis, reported a significant improvement in the mother-infant relationship with term infants, measured with the MIPIS (Walker & Thompson, 1982).

There are two possible explanations for this:

1. Some considerations on the difference found in the results of mother-infant interaction between the different groups (preterm, normal term and with depressed mothers) after the infant massage training could be made starting from a study done by Underdown, Norwood, and Barlow (2013): they aimed to identify the contextual factors and program mechanisms that were associated with different outcomes of massage therapy on the infant by using a realist mixed-methods research design to identify the context, mechanism, and outcome (CMO) patterns in the dyads attending infant massage programs. Three key CMP patters were identified: “low risk”, “moderate risk” (they had one to two risk factors over and above their demographic risk) and “high risk” mothers. In the first group (low risk mothers), the lack of improvement of the mother-infant interaction was attributed to an already present reciprocity in the dyad; mothers with moderate risk were the ones that benefited the most from infant massage in terms of parent-infant interaction while mothers categorized at being at high risk showed no benefits from the massage. However, it needs to be remarked how in this last category, the infant massage training followed by the mothers was not conducted by a certified I.A.I.M (International Association of Infant Massage) professional, whose philosophy is to focus on the interaction and on the infant’s signals, but trainings that had another methodology set-up.

Starting from this research, it would be necessary to determine in which of these categories could be inserted the mothers of the previous studies and their risk associated to their condition.

2. The obtained results could be affected by a non-homogeneous intervention that therefore could have given contrasting results. As noted by Bennet et al. (2013), the various studies that have been made on full term babies greatly differ from one another in duration of the intervention offered to the newborns. In this recent meta-analysis it was in fact noted that 2 studies used a single massage intervention (Cigales, 1997; White & Traut, 2009), 10 used a short-term intervention (Arikan, 2008; Ferber, 2002; Jump, 1998; Narenji, 2008; Argawal, 2000, Zhai, 2001, 2002; Na, 2005; Shano, 2005, Shi, 2002), and 19 a medium-term intervention (Koniak-Griffin, 1988; Field, 1996; Wang, 1999; Onozawa, 2001; Ke, 2001; Liu C., 2001; Wang, 2001; Duan, 2002; Cheng, 2004; Sun, 2004; Xua, 2004; Ye, 2004; Liu CL., 2005; Lu, 2005; Liu D.Y., 2005; Oswalt, 2007; O’Higgins et al., 2008; Zhu, 2010). Furthermore, the different

forms of massage could have also played a specific role on the results.

Therefore, in order to be able to compare the results more precisely the intervention needs to be more standardized in its operative methodologies, duration and means of evaluation.

6. References

Ainsworth, M.D.S. (1967). *Infancy in Uganda*, Baltimore, Johns Hopkins Press.

Allin M, Matsumoto H, Santhouse AM. (2001). Cognitive and motor function and the size of the cerebellum in adolescents born very pre-term. *Brain*. 124, 60 – 66.

Arikan D., Alp H., Gözüm S., Orbak Z., & Çifçi E.K. (2008). Effectiveness of massage, sucrose solution, herbal tea or hydrolysed formula in the treatment of infantile colic. *Journal of Clinical Nursing*, 17(13), 1754–1761.

Barrera M.E., Rosenbaum P.L., & Cunningham C.E. (1987). Corrected and uncorrected Bayley scores: longitudinal developmental patterns in low and high birth weight preterm infants. *Infant Behavior and Development*, 10, 337–346.

Beckwith L, & Parmelee A.H. (1986). EEG patterns of preterm infants, home environment, and later IQ. *Child Development*, 57, 777–789.

Beebe, B., Knoblauch, S., Rustin, J., & Sorter, D. (2005). Forms of intersubjectivity in infant research and adult treatment. In Beebe, B., Knoblauch, S., Rustin, J., & Sorter, D. (a cura di) in *Forms of Intersubjectivity in infant research and adult treatment*, Other Press, New York, 1-28.

Bigelow, A. E., & Power, M. (2012). The effect of mother-infant skin-to-skin contact on infants' response to the still face task from newborn to three months of age. *Infant*

Behavior and Development, 35, 240-251.

Blaymore Bier J.A., Ferguson A. E., Morales, Y., Liebling, J.A., Oh, W., & Vohr, B.R. (1997). Breastfeeding infants who were extremely low birth weight. *Pediatrics* .100 (6).

Bornstein, M. H., & Lamb, M. E. (1999). *Developmental psychology: An advanced textbook* (4th ed.). Mahwah, NJ: Erlbaum.

Bornstein, M.H., & Suess, P.E. (2000). Physiological self-regulation and information processing in infancy: cardiac vagal tone and habituation. In *Child Development*, 71, 273-287.

Bril, B., & Sabatier, C. (1986). The cultural context of motor development: Postural manipulations in the daily life of Bambara babies (Mali). *International Journal of Behavioral Development*, 9, 439 –453.

Brooten D., Gennaro S., & Brown L. (1998). Anxiety, depression, and hostility in mothers of preterm infants. *Nursing Research*, 37, 213–216.

Carpenter, E. (1955). Space concepts of Aiviliks Eskimos, *Explorations Five*, 131-145.

Carra, C., Lavelli, M., & Keller, H. (2013). Differences in practices of body stimulation during the first 3 months: Ethnotheories and behaviors of Italian mothers and West African immigrant mothers. *Infants Behavior and Development*, 37 (1), 5-15.

Carroll D.A., Denenberg V.H., & Thoman E.B. (1999). A comparative study of quiet sleep, active sleep, and waking on the first 2 days of life. *Developmental Psychobiology*, 35, 43– 48.

Cheng Z., Liu S., & Zhang C., (2004). Effect of touching on the development and sleeping of infants. *Journal of Nursing Science (Surgical edition)*, 19 (24), 10– 12.

Cigales M., Field T., Lundy B., Cuadra A., & Hart S. (1997) Massage enhances

recovery from habituation in normal infants. *Infant Behavior and Development*; 20 (1), 29–34.

Cox, J. L., Holden, J. M. & Sagovsky, R. (1987). Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. *British Journal of Psychiatry*, 150, 782-786

De Boer, R. J. (1969). The Netsilik Eskimo and the origin of human behavior, *MSS*, 8.

Diego M., Field T., & Hernandez-Reif, M.(2005). Vagal activity, gastric motility, and weight gain in massaged preterm neonates. *The Journal of Pediatrics*, 147, 50–55.

Duan Lihong, Li Weihong, & Shi Fentao (2002). Studying impact of touching on growth and development of infants. *Chinese Nursing Research*, 16, 5.

Eckerman C.O., Hsu H.C., Molitor A., Leung E.H., & Goldstein R.F. (1999). Infant arousal in an en-face exchange with a new partner: effects of prematurity and perinatal biological risk. *Developmental Psychology*, 35, 282.

Falladé, S. (1960). Le développement psycho-moteur de l'enfant Africain du Sénégal. *Concours Médical*: 82, 1005–1013.

Feldman, R. (1998). Coding Interactive Behavior (CIB). Ramat-Gan: Bar-Ilan University.

Feldman R., Eidelman A.I., Sirota L., & Weller A. (2002a). Comparison of skin-to-skin (kangaroo) and traditional care: parenting outcomes and preterm infant development. *Pediatrics*, 110, 16–26.

Feldman, R., Weller, A., Sirota, L., & Eidelman, A.I. (2002b). Skin-to-skin contact (Kangaroo Care) promotes self-regulation in preterm infant: Sleep-wake cyclicality, arousal modulation, and sustained exploration. *Developmental Psychology*, 38, 194-207.

Feldman R., & Eidelman A.I. (2003). Skin-to-skin contact (kangaroo care) accelerates autonomic and neurobehavioral maturation in premature infants. *Developmental Medicine and Child Neurology*, 45, 1–8.

Feldman, R. (2004). “Mother-infant skin-to-skin contact: theoretical, clinical, and empirical aspects. *Infants Young Child*, 17, 145-161.

Feldman, R., Singer, M. & Zagoory, O. (2010). Touch attenuates infants’ physiological reactivity to stress. *Developmental Science*, 13, 271-278.

Field, T., Schanberg, S., Davalos, M., & Malphurs, J. (1996). Massage with oil has more positive effect on normal infants. *Journal of Prenatal and Perinatal Psychology and Health*, 11(2), 75-80.

Field T., Grizzle N., Scafidi F., Abrams S., & Richardson S. (1996). Massage therapy for infants of depressed mothers. *Infant Behaviour and Development*, 19(1), 107–112.

Field, T., Hernandez-Reif, M., Diego, M., Feijo, L., Vera, Y., & Gil, K. (2004). Massage therapy by parents improves early growth and development. *Infant Behavior and Development*, 27 (4), 435-442.

Field, T., Diego, M., Hernandez-Reif, M., Deeds, O., Figueiredo, B. & Ascencio, A. (2006). Moderate versus light pressure massage therapy leads to greater weight gain in preterm infants. *Infant Behavior and Development*, 29, 574-578.

Goldstein Ferber, S., Laundon, M., Kuint, J., Wellwe, A., & Zisapel, N. (2002). Massage therapy by mothers enhances the adjustment of circadian rhythms to the nocturnal period in full-term infants. *Developmental and Behavioral Pediatrics*, 23 (6), 410-415.

Goldstein Ferber, S., & Makhoul, I.R. (2004). “The effect of Skin-to-Skin Contact (Kangaroo Care) shortly after birth on the neurobehavioral responses of the term newborn: A randomized, controlled trial. *Pediatrics*, 113, 858-865.

Gray L., Watt L., & Blass E.M. (2000), Skin-to-skin contact is analgesic in healthy

newborns. *Pediatrics*, 105(1).

Grunau Re, Holsti L, Whitfield MF, & Ling E. (2000). Are twitches, startles, and body movements pain indicators in extremely low birth weight infants? *Clinical Journal of Pain*, 16, 37–45.

Harkness, S., & Super, C. M. (2001). Culture and parenting. In M. H. Bornstein (ed.), *Handbook of parenting* (pp. 253–280). Hillsdale, NJ: Erlbaum.

Hernandez-Reif M, Diego M, & Field T. (2007) Preterm infants show reduced stress behaviors and activity after 5 days of massage therapy. *Infant Behavior & Development*, 30, 557–61.

Hertenstein M. J., & Campos, J. J. (2001). Emotion regulation via maternal touch. *Infancy*, 2, 549-566.

Hertenstein M. J. (2002). Touch: Its communicative functions in infancy. *Human Development*, 45, 70-94.

Holditch-Davis, D. (1990) The development of sleeping and waking states in high-risk preterm infants. *Infant Behavior and Development*, 13, 513–531.

Hofer, M.A. (1995). Hidden regulators: implication for a new understanding of attachment, separation and loss. In: Goldberg S, Muir R, Kerr J, eds. *Attachment Theory: Social, Developmental, and Clinical Perspectives*. Hillsdale, NJ: Analytic Press.

Jean, A. D. L., & Stack, D.M. (2009). Functions of maternal touch and infants' affect during face-to-face interactions: New directions for the Still-Face. *Infant Behavior and Development*, 32, 344-349.

Jean, A. D. L., Stack, D.M., & Fogel, A. (2009). A longitudinal investigation of maternal touch across the first six months of life: Age and Context effects. *Infant*

Behavior and Development, 32 (3), 344-349

Jean, A. D. L., & Stack, D.M. (2012). Full term and very-low-birth-weight preterm infants' self-regulation behaviors during a Still-Face interaction: Influence of maternal touch. *Infant Behavior and Development*, 35, 779-791.

Jump V. (1998). Effects of Infant Massage on Aspects of the Parent- Child Relationship: An experimental Manipulation. Logan, UT: Utah State University.

Ke G., Ling X., & Li L. (2001). Clinical survey of improved massage method developing infants' growth and development. *China Nurse*, 36 (4), 278–280.

Keller, H., Yovsi, R. D., & Völker, S. (2002). The role of motor stimulation in parental ethnotheories: The case of Cameroonian Nso and German women. *Journal of Cross-Cultural Psychology*, 33, 398–414.

Keller, H., Borke, J., Staufenbiel, T., Yovsi, R. D., Abels, M., Papaligoura, Z., Jensen, H., Lohaus, A., Chaudhary, N., Lo, W., & Su, J. (2009). Distal and proximal parenting as alternative parenting strategies during infants' early months of life: A cross-cultural study" *International Journal of Behavioral Development*, 33, 412–420.

Keller, H., & Otto, H. (2009). The cultural socialization of emotion regulation during infancy. *Journal of Cross-Cultural Psychology*, 40, 996–1011.

Keller, H., & Kärtner, J. (2013). Development. The cultural solution of universal developmental tasks. In M. Gelfand, C. Y. Chiu, & Y. Y. Hong (Series eds.) *Advances in culture and psychology*, Vol. 3. New York: Oxford University Press.

Kim T.I., Shin Y.H., & White-Traut A.C. (2003) Multisensory intervention improves physical growth and illness rates in Korean orphaned newborn infants. *Research in Nursing & Health*, 26(6), 424–433.

Koniak-Griffin D., Ludington-Hoe S., & Verzemnieks I. (1988). Developmental and

temperament outcomes of sensory stimulation in healthy infants. *Nursing Research*, 37(2), 70–76.

Lamm, B., Keller, H., Yovsi, R. D., & Chaudary, N. (2008). Grandmaternal and maternal ethnotheories about early child care. *Journal of Family Psychology*, 22, 80–88.

Lavelli, M., & Fogel, A. (2005). Developmental changes in the relationships between infant's attention and emotion during early face-to-face communication: The 2-month transition. *Developmental Psychology*, 41, 265-280.

Lavelli, M. (2007). Intersoggettività, origini e primi sviluppi Milano: Raffaello Cortina.

Laviola G., & Terranova M.L. (1998). The developmental psychobiology of behavioral plasticity: the role of social experiences in the family unit. *Neuroscience & Behavioral Reviews*, 23, 197-213.

LeVine, R. A., & LeVine, S. E. (1963). Nyansongo: A Gusii community in Kenya. New York: Wiley.

Lester B.M., Boukydis C.F., & Garcia-Coll C.T. (1995). Developmental outcome as a function of the goodness of fit between the infant's cry characteristics and the mother's perception of her infant's cry. *Pediatrics*, 95, 516 –521.

Liu Chun Li (2005). The effect of touching on healthy infants' weight. *Journal of Huaihai Medicine*, 23 (2), 137.

Liu Chunyang, Liu J., & Lin Xiaojun (2001). Effects of touch on growth and mentality development in normal infants. *Chinese Medical Journal (Chung-Hua i Hsueh Tsa Chih)*, 81(23), 1420–1423.

Liu D.Y. (2005). Clinical experience in infant massage. 100 case studies. *Chongqing Medicine*, 34(7), 301.

Lu Jiao, Li Ju Zhan, & Wu Li Fang (2005) A study of the effect of touch on health in

infants. *Practical Clinical Medicine*, 6(2), 119–122.

Malatesta C.Z., Grigoryev P., Lamb C., Albin M., & Culver C. (1986). Emotion socialization and expressive development in preterm and full-term infants. *Child Development*, 57, 316–330.

McCall R.B., & Carriger M.S. (1993). A meta-analysis of infant habituation and recognition memory performance as predictors of later IQ. *Child Development*, 64, 57–79.

Minde K., Whitelaw A., Brown J., & Fitzhardinge P (1983). Effect of neonatal complications in premature infants on early parent-infant interaction. *Developmental Medicine and Child Neurology*, 25, 763–777.

Montagu, A. (1971). *Touching: The human significance of the skin*. New York: Columbia University Press.

Montagu, A. (1986). *Touching: The human significance of the skin*. (3rd ed.). New York: Harper & Row.

Muscarella, E. (1996). Infant massage provides invaluable benefits. *PT Bulletin*, 11-18.

Narenji F., & Rosbahany N. (2008) The effects of massage therapy on weight gain and sleep behaviors in infants. *Koomesh Journal of Semnan University of Medical Sciences*, 9(4), 279–28.

Na Zhuo Hua, Xie Hui Yun, & Huang Jian Hua (2005)The effect of infant massage on growth. *New Journal of Traditional Chinese Medicine*, 37(5), 69–70.

Neu, M., Hazel, N., Robinson, Schmiede, J.A., & Laudenslager, M.L. (2014). Effect of holding on co-regulation in preterm infants: a randomized controlled trial. *Early Human Development*

O'Higgins, M., St. James Roberts, I., & Glover V. (2008). Postnatal Depression and mother infant outcomes after infant massage. *Infant Behavior and Development*, 109(1-2), 189-192.

Onozawa, K., Glover, V., Adams, D., Modi, N., & Kumar R.C. (2001). Infant massage improves mother–infant interaction for mothers with postnatal depression. *Journal of Affective Disorders*, 63, 201–207.

Oswalt K.L. (2007). Outcomes of Massage Interventions on Teen Mothers and their Infants [M.A. thesis]. Vol. vii, p. 50. Birmingham, AL: University of Alabama at Birmingham.

Penman R., Meares, R., Baker, K., & Milgrom-Friedman, J. (1983). Synchrony in mother-infant interaction: a possible neurophysiological base. *British Journal of Medical Psychology*, 56 (1), 1-7.

Porges, S.W., Doussard-Roosevelt, J.A., & Maiti, A.K. (1994). Vagal tone and the physiological regulation of emotion. *Monograph of the Society for Research in Child Development*, 59, 167-186.

Righard L, Alade M. (1990). Effect of delivery room routines on success of first breastfeed. *Lancet*, 336, 1105–1107.

Ruff, H.A. (1986). Attention and organization of behavior in high-risk infants. *Journal of Developmental and Behavioral Pediatrics*, 7, 298–301.

Sander, L. (1975). Bambino e ambiente di accudimento. Indagine e concettualizzazione del comportamento adattivo in un sistema di crescente complessità. Tr. It in Sander L., *Sistemi viventi. L'emergere della persona attraverso l'evoluzione della consapevolezza*. Raffaello Cortina, Milano 2007, 101-123.

Sander, L. (1977). The regulation of exchange in the infant-caretaker system and some aspects of the context-content relationship. In Lewis, M., & Rosenblum, L., (Eds.), *Interaction, conversation and the development of Language*. Wiley, New York, 133-156.

Spitz, R. A.(1965). *The first year of life: a psychoanalytic study of normal and deviant development of object relations*. New York: Basic Books.

Scafidi, F.A., Field, T.M., Schanberg, S.M., Bauer, C.R., Tucci, K., Roberts, J., Morrow, C., & Kuhn C. M. (1990). Massage simulates growth in preterm infants: A replication. *Infant Behavior and Development, 13*, 167-188.

Shao L. (2005) The effect of infant massage on health: a nursing experience. *Journal of Chinese Clinical Research, 11*(11), 1582–1583.

Shi Li, & Xue Li Rong (2002) The clinical observation of touching towards the neonatal health's affection. *Journal of Henan University, 21*(4), 26–27.

Stack, D. M., & Muir, D.W. (1992). Adult tactile stimulation during face-to-face interactions modulates 5-months-olds' affect and attention. *Child Development, 63*, 1509-1525.

Stack, D. M., LePage, D.E., Hains, S., & Muir, D.W. (1996). Qualitative changes in maternal touch as a function of instruction condition during face-to-face social interaction. *Infant Behavior and Development, 19*, 761.

Stack, D.M., & LePage, D.E. (1996). Infants' sensitivity to manipulations of maternal touch during face-to-face interactions. *Social Development, 5*, 41–55.

Stack, D.M., & Arnold, S.L. (1998). Changes in mothers' touch and hand gestures influence infant behavior during face-to-face interchanges. *Infant Behavior & Development, 21*, 451–468.

Stack, D. M. (2010). Touch and physical contact during infancy: Discovering the richness of the forgotten sense. In J. Gavin Bremner, & T. D. Wachs (Series eds.) *Wiley-Blackwell handbook of infancy development: Vol. 1*. (2nd ed., Vol. 1, pp. 535–567). England: Basic Processes.

Sun Hai Yun, Gao Xiang Yu, & Zhao Xue Mei (2004). A comparative study on influence of touching on growth, development and jaundice of normal infants. *Chinese Nursing Research*, 18(8B), 1468–1469.

Super, C., & Harkness, S. (1996). The cultural structuring of child development. In J. W. Berry, P.R. Dasen, & T.S. Saraswathi (Vol. eds.), *Basic processes and human development: Vol. 2. Handbook of cross-cultural psychology* (2nd ed., Vol. 2, pp. 1–39). Boston: Allyn & Bacon.

Tronick, E. Z. (1995). Touch in mother-infant interactions. In T.M. Field (ed.), *Touch in early development* (pp.53-65). Hillsdale, NJ: Erlbaum.

Underdown, A., Norwood, R., & Barlow, J. (2013). A realist evaluation of the processes and outcomes of infant massage program. *Infant Mental Health Journal*, 34 (6), 483-495.

Vohr B.R., & Garcia Coll C.T. (1985). Neurodevelopmental and school performance of very low birthweight infants: a seven-year longitudinal study. *Pediatrics*, 76, 345–350.

Vohr B.R., Wright L.L., & Dusic A.M. (2000) Neurodevelopmental and functional outcomes of extremely low birth weight infants in the National Institute of Child Health and Human Development Neonatal Research Network, 1993–1994. *Pediatrics*, 105, 1216 –1226.

Walker, L. D., & Thompson, E. T. (1982). *Mother-Infant Play Interaction Scale*. In S.S. Humenick (ed.). Analysis of current assessment strategies in the health care of young children and childbearing families. Appleton-Century-Crofts.

Wang Bin, Shen Yue Hua, & Jin Run Yan (1999). Improving infant growth by massage: a clinical study. *Chinese Journal of Perinatal Medicine*, 2(4), 241–242.

Wang L.X., He Q., & Liu Y.L. (2001). The effects of infant massage on the development

of infant intelligence and body weight. *Chinese Journal of Child Health Care*, 6, 409–411.

Whitelaw, A., Heisterkamp, G., Sleath, K., Acolet, D., & Richards, M. (1988). Skin-to-skin contact for very low birthweight infants and their mothers. *Archives of diseases in Childhood*, 63, 1377-1381.

White-Traut, R.C., Schwertz, D., McFarlin, B., & Kogan, J. (2009). Salivary cortisol and behavioral state responses of healthy newborn infants to tactile-only and multisensory interventions. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*, 38(1), 22–34.

Wolff, P.H. (1963). Observations on the early development of smiling. In Foss, B.M. (a cura di), *Determinants of Infant behavior: II*. Methuen, London, 113-138.

Xua Li Shuan, Qing Gui Romg, & Ye Mei Yan (2004). Study of touch intervention of infant sleep disorder. *Journal of Nursing Continual education*, 19(11), 973–976.

Ye Hong Yun (2004). Clinical observation on infant massage. *Journal of Gan Nan Medical College*, 3, 239–40.

Zhai J., Pan Xian R., & Hua J.R., (2001). The effect of massage on growth: a clinical study. *Journal of Sichuan Continuing education College of Public Health and Managerial Sciences*, 20(10)

Study 1- Effects of infant massage on maternal touch

Abstract

Background: Maternal touch plays a fundamental role in mother-infant interaction, both for infant development and mother-infant co-regulation. In particular, quality of maternal touch has been reported to play a fundamental role in infant's emotions regulation and behavior.

Aim: This study aims to examine maternal touch in mother-infant spontaneous interaction before and after a 2-month period of infant massage experience.

Method: 42 mother-infant dyads were recruited: 22 dyads (Target Group) received a 5-week training of infant massage from the beginning of the second month of the infant's life to the beginning of the third one; 20 dyads participated in the study as Control Group. Mother-infant dyads of both groups were videotaped during spontaneous face-to-face communication, for 5 minutes in the natural context of their home, when the infant was 1 and 3 months old. Maternal touch was coded second by second using a revised version of the Ordinalized Maternal Touch Scale (Beebe, 2010).

Results: Before the infant massage training (i.e., at 1 month) maternal touch behaviors in both groups were similar, in terms of quantity and quality. From 1 to 3 months the total amount of touch decreased in both groups of dyads, but significantly only in the Control group. Affectionate touch decreased in both groups, but in the Target Group remained significantly higher than in the Control Group. Playful touch increased in both groups, but significantly only in the Target Group.

Conclusion: These findings suggest that infant massage is an important way to improve maternal touch in mother-infant interaction, both in terms of quantity and of quality. Improving mother-infant communication through touch may have an important positive impact on infant development, mother-infant co-regulation and infant attachment.

Keywords: infant massage, maternal touch, mother-infant interaction

1. Introduction

Maternal touch, which along with other behaviors such as close physical proximity, constitutes the “maternal postpartum repertoire”, is the basic mammalian maternal behavior (Feldman, 2003) and it has a crucial role in survival, growth, development and adaptation of the young.

Over the milestone study of Harlow on Rhesus macaques (1957), in which was demonstrated that baby monkeys preferred a surrogate sponge mother who did not provide food than a surrogate metal mother providing nourishment, lot of studies show the central role of tactile stimulation for the development of nonhuman species, as maternal washing, grooming, licking and handling to assure the survival and growth of the newborn, in addition to an increasing in exploratory behavior and strength against illnesses (Stack, 2003). In fact, Bernstein (1954), documented that rats who received a 10-minutes holding in experimenter's hand every day had better maze performances and one of the first studies (Hammet, 1922) showed more chances to survive thyroidectomy in rats who received more gentle handling. Furthermore, rats that were handled or received a gentle touch or brush- stroking gained more weight compared to a control group (McClelland, 1956) while rats who were handled before weaning demonstrated more emotional stability during stress in adulthood (Levine & Otis, 1958).

In the human species, maternal touch has underlined to be an important channel of communication between mother and infant, especially to communicate different emotions, as tenderness and security (de Chateau, 1976; Moszkowski & Stack, 2007; Stack, 2001; Stack, 2004; Tronick, 1995), and a modality to promote emotion regulation and to elicit the increasing of positive affect and the reduction of stress in infants (Stack & Muir, 1992; Tronick, 1995; Weiss, Wilson, Hertenstein, & Campos, 2000). Recent findings suggest that is a specific touch's aspect, the quality, that plays the fundamental role in infant's emotions regulation and behavior (Hertenstein, 2002; Jean & Stack, 2009; Moreno et al., 2006; Stack & Muir, 1992; Stack, 2010; Jean & Stack, 2012). As reported in Moreno et al. (2006) and Stack & Jean (2011) mothers tend to use affectionate and nurturing touch in order to relax their infants, while they use playful touch to induce infant's smiling during mother-infant interaction.

From the first moments of life, maternal touch plays a fundamental role infant's neurobehavioral, cognitive, socio-emotional systems. Feldman (2003) found that in

premature infants, the increasing of maternal affectionate touch and maternal postpartum behavior was a consequence of breastfeeding, and the mothers who used this modality of feeding had infants with better cognitive development and an higher neurobehavioral maturation assessed through the Neonatal Behavior Assessment Scale (Brazelton, 1973) at 6 months. Furthermore, it is vital to underline the importance of affectionate maternal touch in early stage of infant's life in terms of development of dyadic synchrony, as a correlation was found between the amount of affectionate touch and the degree of synchrony between mother and infant and affectionate touch at 3 months (Feldman & Eidelman, 2007). More reciprocity and sensitivity at 3, 6 and 12 months of infant's life was noticed in mothers who used more touch during postpartum period (Feldman, 2003) and mother with high sensitivity has infants with better cognitive development and better complex symbolic play (Feldman, Eidelman, & Rotenberg, 2004). These findings are of fundamental importance if we consider mother-infant interaction as a dynamic process, in which mother's behavior influences the infant's behavior and vice-versa in a mutually regulated process (Lavelli & Fogel, 2005, 2013) and which involves, among other behaviors, eye contact and the infant's social smile. Specifically, touch has been demonstrated to be a stimulus to increase in particular these two behaviors and face-to-face communication in infants between 1,5 and 3,5 months: in a study conducted through a contingency-based technique, the synchronized reinforcement procedure, infants disclosed more eye contact, vocalizations and smiles and less time crying when the adult could touch the infant, in addition to cooing and smiles, in a face-to-face communication (Pelaez- Noguerras et al., 1996).

Maternal touch is of central interest for the attachment theory too: a number of findings indicated that mothers who use more affectionate touch, through caresses, kisses, hugs and gentle handling, had secure attached infants (Ainsworth, 1957; Bates et al., 1985; Leyendecker et al., 1997; Network, 1997; O'Connor et al., 1992), while mothers who used a less tender touch had insecure attached infants (Schneider-Rosen & Cicchetti, 1984) On the other hand, mothers with disorganized or insecure-avoidant infants used a more abrupt, angry and rejecting touch (Ainsworth et al., 1978; Carlson et al., 1989; Crittenden, 1988; Van der Kolk & Fisler, 1994).

It has been underlined that the amount and quality of touch addressed to infant vary across infant's age, especially in the first months of life: a study developed by Stack and

colleagues (2001), showed that mothers tend to use less touch with 3-month-old infant than with 1 month old infants. Furthermore, a decrease in affectionate touch such as stroking has been observed, along with an increases in playful touch, as tickling.

In this study, we consider touch in the perspective of infant massage.

Infant massage is a traditional practice in different parts of the world, for example Africa, India, Bangladesh and it's normally handed down from one generation to another. In the last 20 years this practice has been rediscovered among the population, scientific protocol and research field (Muscarella, 1996), particularly from the mid-80s, when Tiffany Field published her first works on effects of tactile stimulation on preterm infants and when Vimala McClure, who had discovered the power of infant massage during a period of work in India, founded the International Association of Infant Massage (IAIM). During these decades, it has been shown that infant massage, that includes different types of touch, as tactile stimulation and kinesthetic movements, has several benefits, both for infants and for mother-infant relationship. It allows relaxation both in infants and mothers (Uvnas-Moberg, 2012), stimulates hormonal and blood circulatory systems, regulates circadian rhythms (Goldstein Ferber, Laudon, Kuint, Weller, & Zisapel, 2002), enhances the quality of sleep (Scafidi et al., 1990; Xua et al., 2004) and promotes early growth and development in premature infants. (Field et al., 2004). Several studies underlined that infant massage improves mother-infant interaction (Lee, 2006), especially in dyads with mothers with postnatal depression and in case of prematurity (O'Higgins, St. James Roberts, & Glover, 2008; Onozawa, Glover, Adams, Modi, & Kumar, 2001).

Infant massage is a practice that fosters mother-infant relationship through different elements that include not only tactile and kinesthetic stimulation, but social smiling, eye-contact, communicative signals by infants too (Purpura et. al, 2016). During infant massage classes carried out using the IAIM method, mothers are guided by a certified instructor to recognize infant signals and cues and adapting their touch behavior as a consequence.

No previous research investigated the impact of maternal touch in mother-infant interaction in a context in which infant massage is used.

This work aims to assess whether there are some differences in maternal touch during spontaneous mother-infant dyadic interaction after an infant massage training and after

a 2-month-period of infant massage everyday experience. Maternal touch was compared in two groups, Target and Control, before and after the infant massage experience, that is, at 1 month and 3 months of infant's age.

On the whole, we hypothesized that after the experience of infant massage, maternal touch is likely to improve in terms of both quantity (i.e., use of touch in mother-infant communication, though expecting a decrease with the increase of the infant's age) and quality. Therefore, we expected to find more differences between the Target group and the Control group in terms of quantity and quality of maternal touch at 3 months than at 1 month, due to a "tactile education" received by mothers in the Target group through the infant massage training. We made the following specific hypotheses.

1. First, we expected maternal touch in the Target group to be more frequent than in the Control group at 3 months. (The first hypothesis was that maternal touch in the Target group at 3 months would be more frequent than in the Control group). Prior evidence has shown that at 3 months the amount of maternal touch decreases; however, we supposed that in dyads who experimented infant massage in their routine, maternal touch may be kept in considerable amount, as an important communication modality in mother-infant interaction.
2. Second, we expected to find developmental changes in quality of maternal touch from 1 to 3 months postpartum (i.e., different types of touch prevailing at 1 and 3 months), regardless of the group, due to a main transition in infant development that occurs toward the end of the second month (Lavelli & Fogel, 2005). Indeed, the acquisition of exogenous control (Emde & Buchsbaum, 1989) marks the beginning of an active engagement in communication with the caregiver on the part of the infant (Lavelli & Fogel, 2002), so that mothers tend to adapt their behaviors –included tactile behaviors– to this transformation (Stack, 2008). With regard to this, prior evidences have shown that, compared to the first month of life, the amount of maternal affectionate touch addressed to the infant decreases at 3 months; at the opposite, a more playful maternal touch increases from 1 to 3 months. On the basis of this literature, we therefore expected to find an overall decrease of Affectionate touch at 3 months, but a less relevant decrease in the Target Group than in the Control Group. At the opposite, we expected to find an overall increase in Playful touch in both groups, but more in mother-infant dyads who experimented infant massage. Furthermore, we expected to find a decrease in overall duration of static

touch in the Target Group, due to a more varied use of touch on the part of the mothers who were trained to massage their infants. In addition, we made hypotheses on how specific maternal tactile behaviors that are part of ‘static’ vs. ‘affectionate’ vs. ‘playful’ touch addressed to the infant might change according to the infant age and the experience of infant massage.

3. With regard to Static touch, we expected tactile behaviors which are just static –such as keeping a hand on the infant body– to decrease over time in both groups, and types of static touch that engage the infant more actively –such as providing a finger for the infant to hold or to play– to increase from 1 to 3 months in both groups, because of maternal co-regulation with the infant’s developing interacting abilities.
4. With regard to Affectionate touch, on the basis of the literature discussed above, we expected all affectionate tactile behaviors –particularly behaviors such as stroking, which are more frequently used when infants are less active in interaction – to decrease from 1 to 3 months in both groups. Furthermore, despite the assumed decrease, we expected to find a higher presence of tactile affectionate behaviors in the Target group than in the Control group, due to an increased use of touch to communicate with the infant learned through the experience of infant massage.
5. Finally, with regard to Playful touch, on the basis of the literature discussed above, we expected all types of playful tactile behaviors –such as jiggling, bouncing, tapping, gently extending and flexing the infant’s arms and legs– to increase from 1 to 3 months, with the emergence of the infant’s social abilities and the increase of playfulness and complexity of mother-infant interaction, in both groups. In addition, we expected to find a larger use of playful touch in the Target group than in the Control group, due to a supposed larger use of tactile communication in mother-infant interaction developed through the infant massage experience.

2. Method

2.1 Participants

Participants were 42 mothers and their full-term infants, 23 males and 19 females, recruited at the “Policlinico G.B. Rossi” Hospital in Verona and the “Sacro Cuore” Hospital in Negrar (Verona) during the first 3 days after the deliver. About 300 mothers

were informed about the study; 80 mothers consented to be contacted at the third week of infant's life and 42 of them accepted to participate in this study.

Mothers recruited in the first Hospital ($N=22$) were contacted to take part to a study on infant massage (Target Group); mothers recruited in the second Hospital ($N=20$) were contacted to be involved in a study in the development of mother-infant interaction (Control Group).

Mother-neonate dyads were selected on the basis of (a) absence of obstetrical and neurological complications (no particular medication during pregnancy and delivery; full term delivery, normal birth weight, above 2,500 g), (b) absence of medical indications or physical or psychological disease on the part of the mothers, (c) the mother's age being above 20 and under 40 years and both the mother and father being Italian. In the Target Group, gestational age was 39 weeks ($SD=0.77$), weight at birth 3.251 ($SD=0.26$); 20 infants were born with natural delivery, 2 with caesarian; maternal age was 31.27 ($SD=2.93$) and the years of education were 16.54 ($SD=4.74$); twenty out of 22 infants were initially breast fed. In the Control group, gestational age was 39.27 ($SD= 0.90$), weight at birth 3.147 ($SD=0.45$). Maternal age was 34 ($SD=3.52$), and the years of education were 15.36 ($SD= 3.52$). Nineteen out of 20 infants were initially breast-fed.

Mothers' and infants' characteristic are detailed in Table.1 and Table.2, respectively.

Table 1. *Maternal characteristics*

	Target ($n=22$)		Control ($n=20$)	
	Mean	SD	Mean	SD
Age	31.27	2.93	34.00	3.52
Years of education	16.54	4.74	15.36	2.37
Breast-feeding at 1 month	20		19	
Bottle-feeding at 1 month	2		1	

Table 2. *Infant's characteristics*

	Target (<i>n</i> =20)		Control (<i>n</i> =20)	
	Mean	SD	Mean	SD
Females	11		9	
Males	11		11	
Weeks at birth	39	0.77	39.27	0.90
Weight at birth	3.25	0.26	3.147	0.45

2.2 Procedure

Mothers who gave the availability, during the recruitment at the Hospitals, to be recalled, were contacted by the researcher when the infants were about 3-weeks-olds.

The mothers who accepted to take part in the study, received the visit by the researcher at 1 month of infant's life. During this visit, in the natural context of their house, dyads were videotaped in a 5 minutes mother-infant spontaneous face-to-face interaction, with the modality described in the *Videotaping* section.

Then, every dyad in the Target group received a 5-week training of infant massage at home, starting the following week. We choose the one-to-one modality instead of the small group modality to train mothers in order to adapt each mother's need and to be sure that mothers could attend every lesson.

At 3 months of infant's life another videotaping of mother-infant face-to-face spontaneous interaction, conducted with the same modality, was realized with all dyads.

2.3 Videotaping

To assess any changes in mother's touch during mother-infant interaction, dyads were videotaped at their home at 1 and 3 months of infant's age during 5 minutes of face-to-face spontaneous interaction. Infant was placed in a semi-reclined position over some pillows on the sofa, with a mirror positioned behind his back; mother was seated close to the infant in a face-to-face position, at about 30 cm of distance. A videocamera, positioned on a tripod at about 2 meters of distance, recorded infant face, infant body, mother's hands and mother's face reflected in the mirror. The requisite for infant to start videotaping was quite alert state; mothers were instructed to behave with infants as they normally used to do during social interaction.

2.4 Infant massage training

The Target group was involved in a 5-week infant massage training provided by a certificate IAIM instructor, between the beginning of the second month and the beginning of the third month of infant's life. Mothers were instructed to massage the infant possibly one a day until 3 months, when infant was in a active or quiet alert state. Mothers were trained to pay attention to their infant's signals of availability before starting and during the massage, as bright eyes, quiet alert state, eye contact, and unavailability, as pre-sleeping state, or fussy, or clumsy movements.

The first week mothers learned how to massage their infant's feet and legs; the second week they learned to massage the infant's tummy and chest; the third was dedicated to arms and face; the fourth to the back and the last one mothers learned some playful movements to mobilize infant's arms and legs.

IAIM program, developed by Vimala Mc Clure, is a sum of Indian and Swedish techniques, yoga and techniques developed by Vimala herself (McClure, 1983). The whole massage includes tactile stimulation (through caresses, gently squeezes, pressures) of feet, legs, belly, chest, arms, face and back, and kinesthetic stimulation, specifically flexions and extension of arms and legs. Session's time lasted approximately 20 minutes, depending on the infant's state and availability.

2.5 Coding

A revised version of the Ordinalized Maternal Touch Scale (Beebe et al., 2016), was used to code the videos second by second; only the first 180 seconds were analyzed. We used 10 mutually exclusive categories: 8 categories of maternal touch to describe

different types of tactile behaviors, ordinalized according to their quality; 1 category to describe all the tactile behaviors that was not possible to include in the previous 8 categories; 1 category for no touch behavior. Each category was composed by different types of touch behaviors: Affectionate Touch (stroke, caress, kiss, nuzzle, pat), Static Touch (hold, provide hand or finger for infant to hold), Playful Touch (tap, tickle, rub, large movements with arms or legs, jiggle, bounce), No Touch, Caregiving (reposition infant in infant seat; wipe infant's mouth; adjust infant's clothing; adjust strap in infant seat); Oral Touch (any tactile stimulation directed to the infant's mouth); Object-mediated Touch (waves cloth in infant's face, dangles toy on infant's chest, manipulates clothing for non-caregiving purpose); Rough Touch (scratch, pull, push, pinch), Intrusive Touch (any type of high intensity touch); Other (types of touch that could not be included in the previous categories). More detailed descriptions are given in Table 3.

Table 3. *Ordinalized Maternal Touch Scale*

CATEGORIES	TYPES OF TOUCH
Static Touch	Hold or gently squeezed, rest hand or palm on infant, provide hand or finger to hold;
Affectionate Touch	Stroke, caress, kiss, nuzzle, pat;
Playful Touch	Tap, tickle, jiggle, shake, wiggle, flexions, extension, lift arms or legs, circling motions and similar large movements, tap (using one or more fingers), graze, rub;
Caregiving	Caregiving (e.g., reposition infant in infant seat, wipe infant's mouth, adjust infant's clothing, adjust infant's clothing, adjust strap in infant seat, etc.);
Oral Touch	Infant-directed oral touch (e.g., offer finger for infant to suck, put finger in infant's mouth, put infant's hand in infant's mouth, put infant's toes in infant's mouth);
Object mediated Touch	Waves clothes on infant's face, dangle toys on infant's chest, manipulates clothing for non-caregiving purpose;
Rough Touch	Push, inhibit/constrain movements, force infant's foot into infant's face, force infant's hand down)
Intrusive Touch	Any type of touch with high intensity
No Touch	No touch
Other	Other type of touch that was not possible to include in the previous categories
Uncodable	Uncodable behavior due to changes of position of the mother

2.6 Reliability

The inter-rater reliability for maternal touch behaviors was calculated on a random sample of 16 videos (20% of 84), which were coded by a second coder, blind to the aims of the study. The average Cohen's Kappa was .85 (range from .75 to .96).

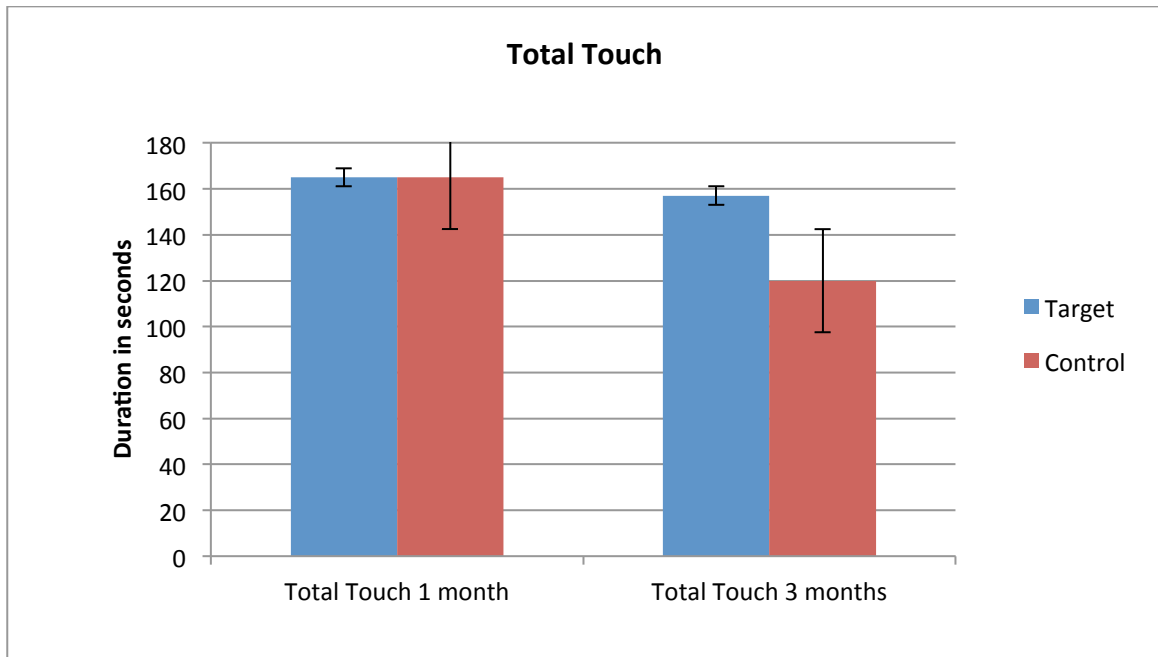
3. Results

3.1 Total Amount of Maternal Touch

In order to assess and compare the overall duration of maternal touch according to infant's age (which corresponds to time pre- and post- infant massage training) and group, we conducted a 2 x 2 mixed-design analysis of variance (ANOVA) with age (1 month vs. 3 months) as the within-subjects factor and group (Target vs. Control) as the between-subjects factors on the total amount of touch (i.e., the sum of the different categories of maternal touch) and No touch. The analysis performed on the total amount of touch showed a main effect for age, $F(1,39) = 16.87, p < .001, \eta_p^2 = .30$, and for interaction of age x group $F(1,39) = 8.24, p = .007, \eta_p^2 = .17$. Pair samples corrected t-tests used as post hoc tests within group revealed that the total amount of maternal touch addressed to the infant decreased significantly from 1 to 3 months only in the Control group, $t(18) = 3.77, p < .001$. T-tests used as post hoc tests between groups revealed that at 3 months the total amount of maternal touch addressed to the infant in the Target Group ($M = 157.1, SD = 34.42$) was significantly higher than in the Control Group ($M = 119.5, SD = 52.12$), $t(32) = 2.69, p < .001$. No differences were found in amount of touch used by mothers at 1 month, between the two groups.

Consistently, also for No Touch the ANOVA showed a main effect for age, $F(1,39) = 15.33, p < .001, \eta_p^2 = .28$, and for the interaction age x group, $F(1,39) = 11.09, p = .002, \eta_p^2 = .22$. Corrected t-tests confirmed that the total amount of No touch increased significantly from 1 to 3 months only in the Control group, $t(18) = -4.10, p < .001$ and only at 3 months was significantly higher in the Control Group ($M = 60.5, SD = 52.80$) than in the Target Group ($M = 22, SD = 26.73$), $t(21) = -3.24, p < .001$.

Figure 1. Total amount of maternal touch



3.2 Quality of Maternal Touch

In order to assess any differences in quality of maternal touch, that is, induration of different types of maternal touch according to infant's age (i.e., time pre- and post-infant massage training) and group, we conducted a 2 x 2 mixed- design ANOVA with age (1 month vs. 3 months) as the within-subjects factor and group (Target vs. Control) as the between-subjects factor on each type of observed touch. Since Object mediated touch and Intrusive touch were not observed, and Rough touch was observed only rarely in both groups, these categories of touch quality were excluded from statistical analyses. Descriptive data for all types of maternal touch and specific tactile behaviors included in the main types of touch are reported in Table 4.

Static touch

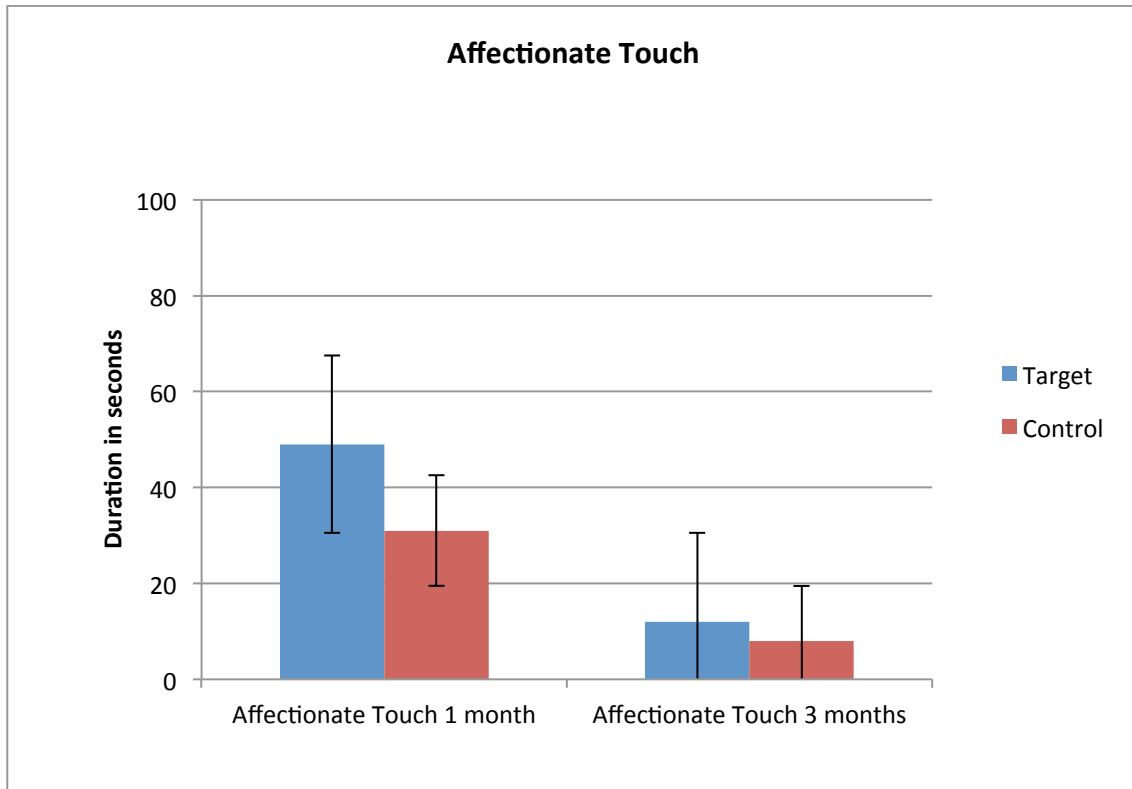
With regard to Static touch, the ANOVA revealed no effect for age or group, nor for the interaction of age x group.

Affectionate touch

With regard to Affectionate touch, the ANOVA showed a main effect for age, $F(1, 39) = 24.65$, $p < .001$, $\eta_p^2 = .38$, and for group, $F(1,39) = 5.05$, $p = .03$. Subsequent corrected t-tests used as post hoc tests within group and between groups showed that

Affectionate touch decreased significantly from 1 to 3 months in both groups: Target $t(21) = 4.44, p < .001$, Control $t(18) = 2.68, p = .04$, but at 3 months it remained significantly higher in the Target group ($M = 18.94, SD = 12.14$) than in the Control Group ($M = 8.84, SD = 8.46$), $t(37) = 2.57, p = .03$.

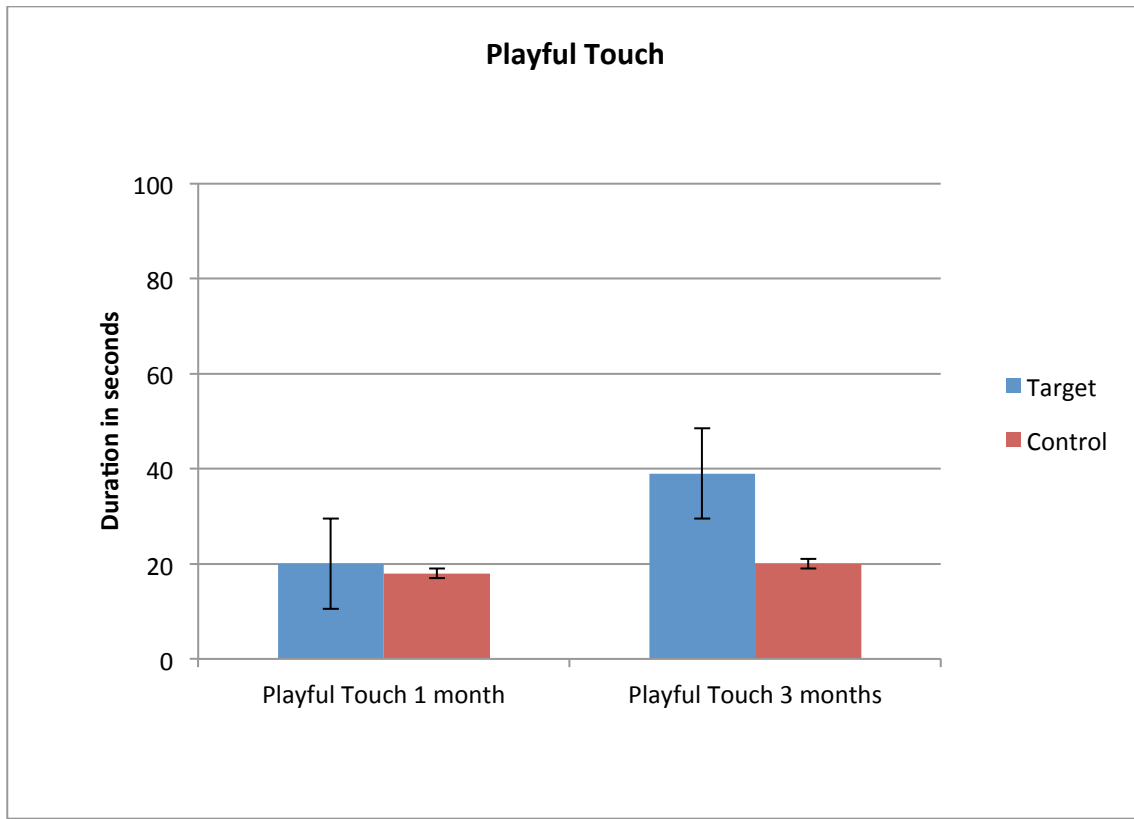
Figure 2. Affectionate Touch



Playful touch

With regard to Playful touch, the ANOVA showed a main effect for age, $F(1,39) = 4.82, p = .03, \eta_p^2 = .11$, and for Group, $F(1, 39) = 4.52, p = .04, \eta_p^2 = .11$. Subsequent corrected t-tests used as post hoc tests within group and between groups showed that Playful touch increased from 1 to 3 months in both groups, but significantly only in Target $t(36) = -2.75, p < .01$.

Figure 3. Playful Touch



Oral touch

No significant differences were found according to age, group, or interaction between age and group for Oral Touch.

Caregiving

No significant differences were found according to age, group, or interaction between age and group for Caregiving.

3.3 Specific tactile behaviors

Descriptive data for specific tactile behaviors included in the main types of touch are reported in Table 4.

Static touch: holding, providing finger for infant to hold

In order to assess whether and how specific maternal tactile behaviors which are part of Static touch change according to the infant age and massage experience, we conducted a 2 x 2 x 2 mixed-design ANOVA with type of Static touch (holding vs. providing finger)

and age (1 month vs. 3 months) as within-subjects factors and group (Target vs. Control) as between-subjects factor.

The ANOVA showed a main effect for type of Static Touch, $F(1,39) = 14.31, p < .001, \eta_p^2 = .26$, and a main effect for the interaction type of Static touch x age, $F(1, 39) = 17.35, p < .001, \eta_p^2 = .30$. subsequent corrected t-test used as post hoc tests within groups and between groups revealed that only holding behavior decreased significantly in the Control Group at 3 months $t(18) = 3.33, p < .001$, while provide finger didn't show any difference.

Affectionate touch: kissing, patting, stroking

In order to assess whether and how specific maternal tactile behaviors which are part of Affectionate touch change according to the infant age and massage experience, we conducted a 3 x 2 x 2 mixed-design ANOVA with types of Affectionate touch (kissing, patting, stroking) and age (1 month vs. 3 months) as within-subjects factors and group (Target vs. Control) as between-subjects factor.

The ANOVA revealed significant effects for types of Affectionate touch, $F(2,78) = 39.97, p < .001, \eta_p^2 = .50$, age $F(1,39) = 23.42, p < .001, \eta_p^2 = .37$, and the interactions between types of Affectionate touch and age, $F(2, 78) = 23.06, p < .001, \eta_p^2 = .3$, and types of Affectionate touch and group, $F(2,78) = 3.10, p = .05, \eta_p^2 = .07$.

Subsequent t-test used as post hoc test showed that and that only stroking decreased significantly in both group, Target: $t(21) = 4.15, p < .001$, Control: $t(18) = 2.86, p = .02$. Furthermore, corrected t-tests used as post hoc tests between groups revealed that, despite the decrease over time, stroking remained significantly higher in the Target group than in the Control group, $t(36) = 2.76, p = .03$.

Playful touch: tapping, tickling, large movements, jiggle-bounce, rubbing

In order to assess whether and how specific maternal tactile behaviors which are part of Playful touch change according to the infant age and massage experience, we conducted a 5 x 2 x 2 mixed-design ANOVA with type of Playful touch (tapping, tickling, large movements, jiggle-bounce, rubbing) and age (1 month vs. 3 months) as within-subjects factors and group (Target vs. Control) as between-subject factor.

The ANOVA showed significant effects for type of Playful touch, $F(4) = 13.12, p < .001, \eta_p^2 = .25$, age, $F(1) = 4.46, p = .04, \eta_p^2 = .10$.

Corrected t-tests used as post hoc tests between groups revealed that Playful tactile behaviors increased significantly at 3 months only in the Target group: Tapping, $t(21) = -2.73, p = .01$; Tickling, $t(21) = -2.50, p = .02$; Large movements of infant's arms and legs, $t(21) = -2.31, p = .03$.

Rub did not show any difference between groups and across age.

Table 4. Specific Type of Touch

Type of touch	Target Group				Control Group			
	1 month		3 months		1 month		3 months	
	M	SD	M	SD	M	SD	M	SD
Affectionate Touch	48.90	34.66	18.81	12.14	30.51	35.79	8.73	8.47
Stroke, caress	45.45	36.16	13.95	11.70	28.15	36.77	5.21	7.71
Kiss, nuzzle	3.45	5.34	4.86	6.46	2.36	2.98	3.52	6.64
Static Touch	76.99	41.74	84.58	41.4	106.04	50.38	79.94	50.86
Hold/ rest hand	54.86	38.05	46.72	29.44	83.10	50.49	35.94	29.63
Provide hand	22.13	28.65	37.86	34.06	22.94	26.02	44.00	39.32
Playful Touch	19.59	18.77	38.68	26.53	18.05	22.14	19.79	17.01
Tap, graze	5.50	7.67	11.00	10.53	5.47	4.92	6.94	8.87
Tickle	1.81	4.04	5.86	8.39	1	4.35	2.10	3.49
Rub	2.45	4.61	2.45	5.96	2.05	4.44	2.21	4.22
Large movements	1.13	3.18	5.13	7.63	2.26	6.91	1.47	3.67
Jiggle/bounce	10.22	13.82	14.18	14.16	6.78	12.94	6.94	13.00
No touch	15.50	27.91	19.27	26.73	13.95	25.48	60.74	52.80
Caregiving	6.81	7.57	6.72	9.19	4.52	5.86	9.10	11.07
Oral touch	4.72	18.38	0.13	0.64	3.31	12.58	0.21	0.71
Object-mediated	0	0	0	0	0	0	0	0
Rough Touch	0	0	0	0	0	0	0	0
Intrusive Touch	0	0	0	0	0	0	0	0
Other	3.72	6.33	7.22	15.58	2.78	8.89	1.73	3.52
Total Touch	165.1	28.19	157.1	34.42	164.9	27.38	119.5	52.12

4. Discussion

The present study focused on possible effects of infant massage experience on maternal touch. Specifically, maternal touch was examined during spontaneous mother-infant interaction before and after 2 months of infant massage experience, compared with maternal touch in a control group of mother-infant dyads. Our hypothesis was that a daily practice of infant massage could produce some changes in maternal touch during spontaneous mother-infant interaction, in terms of both quantity and quality of touch, due to a “tactile education” or, in other words, the acquisition of the ability to adapt their touch to the infant cues and emotion, acquired by mothers through the infant massage experience. The results confirmed our initial hypothesis: mothers who experienced infant massage used a higher amount of touch directed to their infants at 3 months, compared to a control group; moreover, they showed significant differences in quality of touch addressed to the infant, that is, in types of touch prevailing in mother-infant interaction at different infant’s ages.

Our results are consistent with those reported in a study developed by Stack (2009): compared to maternal touch used in mother-infant interaction at 1 month of infant’s life, at 3 months the total amount of maternal touch decreased, as the quantity of affectionate touch; at the opposite, playful touch increased. However, in our sample, the quantity of maternal touch addressed to the infant at 3 months decreased significantly only in the Control Group. This indicates that even if the emergence of new social and emotional competence in infants, indexed by social smile (Ferber, 2008; Stack, 2001), may induce mothers to reduce the use of touch and increase vocal and visual modalities of communication with their infants, mothers who used infant massage in their daily routine demonstrated to give a high importance to touch as a modality to communicate with their infants.

This result is important because maternal touch has been documented to be a modality to reinforce eye contact and infant social behaviors, such as vocalizations of positive affect and smiles, during mother-infant face-to-face interaction (Pelaez-Nogueras, 1996). And a considerable number of studies has shown that a positive experience of early face-to-face interaction is a fundamental condition for the infant development, especially for cognitive (Feldmann & Greenbaum, 1997), social and emotional

(Feldmann, 2007), and language (Bruner, 1983) development. In addition, the quality of mutual regulation in early mother-infant communication affects the developing mother-infant relationship (Hsu & Fogel, 2003; Lavelli & Fogel, 2013), with important consequences for 12-month attachment (Beebe et al., 2010).

With regard to the quality of maternal touch, the decrease in the duration of affectionate touch that was found at 3 months in both groups might be due to the development of more sophisticated regulatory abilities on the part of the infant (Ferber et al., 2008; Stack, 2001). However, in the Target Group affectionate touch remained significantly higher than in the Control group. Previous findings have indicated that mothers who use affectionate touch in interaction with their infants have more secure-attached infants than mothers who use little tactile communication (Ainsworth, 1957); therefore, infant massage could be a modality to keep high levels of maternal affectionate touch during mother-infant communication over the first months of life, and then to promote secure attached mother-infant relationships. Furthermore, high amounts of affectionate touch in the first months of life were found to be associated with higher dyadic reciprocity (Feldman, 2008).

The increase of playful touch observed at 3 months was significantly higher in the Target Group. Stack (2001) reported that mothers tend to use playful touch to elicit infant's smiles; consistently, qualitative observations of our videos suggest that mothers used playful touch to involve their infants in playful interactions, to induce smiles and share fun and positive emotions. This is also supported by the fact that no presence of intrusive touch was found in our data, so, we could suppose that the use of playful touch was in accordance with the infant's emotional state.

Furthermore, our results indicate specific types of tactile behaviors which are more likely to increase or decrease over time in both groups, though in different proportions. Specifically, with regard to the different types of observed static touch, a significant decrease in "holding" behavior from 1 month to 3 months was found only in the Target Group: this could mean that mothers who experimented infant massage are more likely to use more active or affectionate types of touch rather than static tactile behaviors, and to use touch in a more varied way, given the higher amount of total touch that they addressed to the infant. With regard to the different types of affectionate touch, an overall decrease of stroking over time was found in both groups, as reported in previous literature (Stack, 2009). However, the presence of stroking –documented to play a

central role for the development of a secure attachment (Ainsworth, 1957)—at 3 months remained significantly higher only in the Target Group. Finally, for what concerns the different types of playful touch, we found that all types of playful tactile behaviors (except for rubbing) increased significantly only in the Target Group. This result suggests that mothers who experimented infant massage use a large variety of playful movements and tactile behaviors (not demanding nor disrupting) which actively engage their infants in interaction. These findings are of particular relevance if we consider mother and infant as components of a mutual co-regulated process (Lavelli & Fogel, 2005), in which partners' behaviors influence each other and give rise to a coordinated interaction, with important consequences on infant's development.

Taken together, our results indicate that infant massage could be a powerful modality to improve quality in maternal touch and tactile communication addressed to the infant during interaction, therefore to enrich mother-infant interaction through “messages” that are conveyed by maternal touch, starting from the early stage of life.

Finally, it has to be underlined a main limitation of this study: so far, we have still not conducted any analysis of real-time relationships (i.e., significant co-occurrences and transitional probabilities) between maternal touch and infant's behavior during mother-infant interaction. This analysis will be our next research step. At the moment, information on infants' states and emotional expressions are provided by another study that we have conducted to compare mothers' and infants' behaviors and mother-infant co-regulation processes during face-to-face communication before and after the experience of infant massage, and between Target and Control groups.

References

Ainsworth, M. D. S., & Ainsworth, L. H. (1958). *Measuring security in personal adjustment*. Toronto: University of Toronto Press.

Ainsworth, M. S., Blehar, M. C., Waters, E., & Wall, S. (1978). *Patterns of attachment: a psychological study of the strange situation*. Hillsdale, NJ: Erlbaum.

Bates, J. E., Maslin, C. A., & Frankel, K. A. (1985). Attachment security, mother-child interaction, and temperament as predictors of behavior-problem ratings at age three

years. *Monographs of the Society for Research in Child Development*, 50, 167–193.

Crittenden, P. (1988). Relationships at risk. In J. Belsky & T. Nezwarski (eds.), *Clinical implications of attachment* (pp. 136–176). Hillsdale, NJ: Erlbaum.

de Chateau, P. (1976). The influence of early contact on maternal and infant behavior in primiparae. *Birth and the Family Journal*, 3, 149–155.

Ferber, S. G., Feldman, R., & Makhoul, I. R. (2008). The development of maternal touch across the first year of life. *Early Human Development*, 6, 363–370.

Field, T., Hernandez-Reif, M., Diego, M., Feijo, L., Vera, Y., & Gil, K. (2004). Massage therapy by parents improves early growth and development. *Infant Behavior & Development*, 27, 435–445.

Glover, V., Onozawa, K., & Hodgkinson, A. (2002). Benefits of infant massage for mothers with postnatal depression. *Seminars in Neonatology*, 7, 495-500.

Feldman R., Eidelman A.I.(2003). Skin-to-skin contact (kangaroo care) accelerates autonomic neurobehavioral maturation in premature infants. *Dev Med Child Neurol.*, 45:1–8.

Hammett FS. Studies of the thyroid apparatus (1922): V. The significance of the comparative mortality rates of parathyroidectomized wild Norway rats and excitable and non-excitable albino rats. *Endocrinology*, 6, 221–9.

Harlow, H. (1962). Development of the second and third affectional systems in macaque monkeys. In T. T. Turlentes, S. L. Pollack, & H. E. Himwich (eds.), *Research approaches to psychiatric problems*. New York: Grune & Stratton.

Harlow, H. F., & Zimmermann, R. R. (1959). Affectional responses in the infant monkey. *Science*, 130, 421–432.

Hertenstein, M. J. (2002). Touch: Its communicative functions in infancy. *Human Development, 45*, 70–94.

Hertenstein, M. J., & Campos, J. J. (2001). *Emotion regulation via maternal touch. Infancy, 2*, 549–566.

Jean, A. D. L., & Stack, D. M. (2009). Functions of maternal touch and infants' affect during face-to-face interactions: New directions for the still-face. *Infant Behavior and Development, 32*, 123–128.

Lavelli, M., & Fogel, A. (2005). Developmental changes in the relationship between the infant's attention and emotion during early face-to-face communication: The 2-month transition. *Developmental Psychology, 41*, 265–280.

Lavelli, M., & Fogel, A., (2013). Interdyad differences in early mother-infant face-to-face communications: Real time dynamics and developmental pathways. *Developmental Psychology, 49*, 2257-2271.

Leyendecker, B., Lamb, M. E., Fracasso, M. P., & Scholmerich, A. (1997). Playful interaction and the antecedents of attachment: A longitudinal study of Central American and euro-American mothers and infants. *Merrill-Palmer Quarterly, 43*, 24–47.

McClure, V. (1998). *Teaching Infant massage: A handbook for instructors*. Denver: International Associations of Infant Massage.

Moreno, A. J., Posada, G. E., & Goldyn, D. T. (2006). Presence and quality of touch influence co-regulation in mother–infant dyads. *Infancy, 9*, 1–20.

Moszkowski, R. J., Stack, D. M. (2007). Infant touching behavior during mother–infant face-to-face interactions. *Infant and Child Development, 16*, 307–319.

Muscarella, E. (1996). Infant massage provides invaluable benefits. *PT Bulletin*, 11-18.

Network, N. & C. C. R. (1997). The effects of infant child care on infant-mother attachment security: results of the NICHD study of early child care. *Child Development*, 68, 860–879.

O'Connor, M. J., Sigman, M. D., & Kasari, C. (1992). Attachment behavior of infants exposed prenatally to alcohol: mediating effects of infant affect and mother-infant interaction. *Development & Psychopathology*, 4, 243–256.

O'Higgins, M., St. James Roberts, I., & Glover V. (2008). Postnatal depression and mother infant outcomes after infant massage. *Infant Behavior and Development*, 109(1-2), 189-192.

Onozawa, K., Glover, V., Adams, D., Modi, N., & Kumar, R. C. (2001). Infant massage improves mother-infant interaction for mothers with postnatal depression. *Journal of Affective Disorders*, 63, 201-207.

Pelaez-Nogueras M, Gewirtz JL, Field T, Cigales M. (1996). Infants' preference for touch stimulation in face-to-face interactions. *Journal of Applied Developmental Psychology*, 17, 199–213

Purpura, G., Tinelli, F., Bargagna, S., Bozza, M., Bastani, L., Cioni, G. (2014). Effect of early multisensory massage intervention on visual functions in infants with down syndrome. *Early Human Development*, 90 (12), 809-813

Scafidi, F. A., Field, T. M., Schanberg, S. M., Bauer, C. R., Tucci, K., Roberts, J., & Kuhn, C. M. (1990). Massage stimulates growth in preterm infants: A replication. *Infant Behavior and Development*, 13(2), 167–188.

Schneider-Rosen, K., & Cicchetti, D. (1984). The relationship between affect and cognition in maltreated infants: quality of attachment and the development of visual self-recognition. *Child Development*, 55, 648–658.

Stack, D. M. (2001). The salience of touch and physical contact during infancy:

Unraveling some of the mysteries of the somesthetic sense. In G. B. Bremner, & A. Fogel (eds.), *Blackwell handbook of infant development, Vol. 2. Social, emotional and communicative development* (pp. 351–378). Malden, MA: Blackwell Publishers.

Stack, D. M. (2004). Touching during mother-infant interactions. In T. M. Field, J. Freedman (eds.), *Touch and massage in early child development* (pp.49–81). LLC: Johnson and Johnson Pediatrics Institute.

Stack, D. M. (2010). Touch and physical contact during infancy: Discovering the richness of the forgotten sense. In J. G. Bremner, & T. D. Wachs (Series eds.), *Wiley-Blackwell handbook of infancy development, Vol. 1. (2nd ed., Vol. 1, pp. 535–567)*. England: Basic Processes.

Scafidi, F. A., Field, T. M., Schanberg, S. M., Bauer, C. R., Tucci, K., Roberts, J., & Kuhn, C. M. (1990). Massage stimulates growth in preterm infants: A replication. *Infant Behavior and Development, 13*(2), 167–188.

Stack, D. M., & Muir, D. W. (1990). Tactile stimulation as a component of social interchange: New interpretations for the still-face effect. *British Journal of Developmental Psychology, 8*, 131–145.

Stack, D. M., & Muir, D. W. (1992). Adult tactile stimulation during face-to-face interactions modulates 5-months-olds' affect and attention. *Child Development, 63*, 1509–1525.

Stack, D. M., & Jean, A. D. L. (2011). Communicating through touch: Touching during parent–infant interactions. In M. J. Hertenstein, & S. J. Weiss (eds.), *The handbook of touch: Neuroscience, behavior, and health perspective* (pp. 273–298). NY: Springer.

Tronick, & Z. (1995). Touch in mother–infant interactions. In T. M. Field (ed.), *Touch in early development* (pp. 53–65). Hillsdale, NJ: Erlbaum.

Uvnäs-Moberg, K. (2004). Massage and wellbeing, and integrative role for oxytocin? In

T. Field (ed.), *Touch in labour and infancy*. JeJ publishing.

Xua L.S., Qing G. R., Ye M. Y. , et al. (2004). Study of touch intervention of infant sleep disorder. *Journal of Nursing Continual Education*, 19(11), 973–976.

Weiss, S. J., Wilson, P., Hertenstein, M., & Campos, R. (2000). The tactile context of a mother's caregiving: Implications for attachment of low birth weight infants. *Infant Behavior and Development*, 23.

Study 2- Effects of infant massage on mother-infant interaction in the first months of life

Abstract

Background: The quality of mutual regulation in mother-infant interaction in the early stage of life is fundamental for cognitive, emotional and social development; above all, the quality of mutual regulation affects the developing mother-infant relationship, with important consequences for later attachment.

Aims: This study aims to analyze whether there is any qualitative change in mother-infant face-to-face interaction after two months of infant massage experience in mother-infant dyads who added infant massage to their everyday routine, compared with dyads in a Control Group.

Method: 42 mother-infant dyads were assigned to a Target Group, who received 5 weeks of infant massage training from the first to the second month of the infant's life, and to a Control Group. Spontaneous mother-infant face-to-face interaction was videotaped in both groups at 1 and 3 months, in the natural context of their home. Maternal behaviors were coded according to the mother's interactive goals, and infant behaviors were coded according gaze direction and expressive configurations, using Lavelli and Fogel (2013) coding systems.

Results: Both groups followed the typical developmental trajectories in infant behaviors from 1 to 3 months, with a significant increase in Smiling and Excited Attention, but only the Target Group showed a significant increase in infant Cooing and maternal Stimulating behaviors. Also with regard to maternal behaviors, the Target group showed main changes – a significant decrease in Following and an increase in more active behaviors (Affectionate Talking and Stimulating) – which were not found in the Control group.

Conclusions: Infant massage could be a powerful modality to enhance mother-infant interaction in the first months of life.

Keywords: infant massage, maternal touch, mother-infant interaction

1. Introduction

Infants are born with biologically prepared abilities to participate in human interaction, such as the capability to participate in eye contact immediately after birth (Emde, 1983), the ability to recognize their mother's face and the presence of implicit memory (Siegel 2001). It is through dyadic interaction that infants get to know themselves and the world around them: the mutual negotiation during mother-infant communication helps infants to share the creation of meaning with their mothers (Fogel, 1993, 2001; Markova & Legerstee, 2006; Stern, 1985; Tronick, 2004; Vygotsky, 1978).

The quality of mutual regulation in mother-infant interaction in the early stages of life is fundamental for cognitive, emotional and social development (Markova & Legerstee, 2006). Above all, the quality of face-to-face interaction with the mother affects the developing mother-infant relationship, with important consequences for later attachment (Beebe et al., 2010).

Until they are 2 months old, infants show an early form of exogenous smiling when they receive particular stimulation – such as visual, auditory and tactile stimulations – in addition to an endogenous smile that occurs especially during the transition from an alert state to sleep and REM sleep (Emde, 1991, Wolff, 1987). Furthermore, simply by gazing at their mother's face, infants demonstrate that they are engaged in dyadic interaction from the first weeks of life, regulating their own feelings and actions according to those shown by their mothers (Kugiumutzakis, 1999; Murray, 1998; Reddy, Hay, Murray, & Trevarthen, 1997; Trevarthen, 1993, 1998). The 2-month transition, which is closely related to the acquisition of exogenous control (Emde & Buchsbaum, 1989; Emde, Gaensbauer & Harmon, 1976) with the transformation of neural functions (Herschkowitz, Kagan, & Zilles, 1997), marks the beginning of more reciprocal interaction with the caregiver. This is indexed by the presence of the infant's social smiling during interaction (Spitz, 1965), followed by the appearance of pre-speech movements and cooing (Trevarthen, 1979), along with postural head control, longer maintenance of visual attention and more time spent in an active alert state.

Lavelli and Fogel (2005) demonstrated that from this age infant visual attention begins to be associated with emotion expression such as concentration, and from around the third month excited attention is shown during interaction with the mother.

To maintain an adequate level of attention and affect, infants need to have optimal social interaction with their mother, characterized by turn-taking and maternal contingency to their signals (Legerstee, Varghese 2002). Changes in infant sensitivity to maternal contingency have been demonstrated in a famous study carried out by Murray and Trevarthen (1985) using the live-replay video conditions. Infants aged between 6 and 12 weeks displayed indexes of positive affect during interaction with their mothers in the 'live' condition, but they expressed increased indexes of disturbance and negative affect in the 'replay', that is, non-contingent condition.

Maternal contingency to infant cues is expressed through another important modality of communication, namely maternal touch. It is well-known that touch in mother-infant interaction is extremely important to communicate different emotions. Specifically, a study by Stack and colleagues (Stack, LePage, Hains & Muir, 1996) showed that different functions of touch in mother-infant communicative exchanges are related to different emotional states. For example, an active touch can induce positive emotions in the infant, while a nurturing touch can induce a relaxed state.

In order to investigate the role of touch in dyadic interaction, a study by Pelaez-Nogueras and colleagues (1996) involved infants between 1.5 and 3.5 months in two treatment conditions. In the first of these, infant eye contact with the adult was followed by contingent stimulation through adult cooing, smiling and touching by rubbing the infant feet and legs. In the second, infant eye contact was followed by the same adult responses, except for touch. During the first condition, which included touch, infants smiled and vocalized more and showed more eye-contact. Furthermore, infants cried and protested for less time than in the second condition, demonstrating that touch is an important modality to maintain optimal social interaction with the mother.

One modality through which mother and infant can be involved through touch, smiling and eye-contact is infant massage, during which the recognition of the infant's communicative signals and body language plays a fundamental role (Purpura et al., 2016). Infant massage is an everyday routine in many different parts of the world, such as India, Bangladesh and Africa, traditionally transmitted from generation to generation (Muscarella, 1996). It has been underlined that it has several benefits for infant development: it stimulates hormonal and blood circulatory systems, regulates circadian rhythms (Ferber, Laudon, Kuint, Weller, & Zisapel, 2002) and enhances the quality of

sleep (Scafidi et al., 1990; Xua et al., 2004) and early growth and development in premature infants (Field et al., 2004).

This ancient practice has been shown to have several benefits for mother-infant interaction too: a study developed by O'Higgins, Robert, and Glover (2008) found that mothers with postnatal depression who experimented with infant massage in their routine showed a significant reduction of depression symptoms in the EPDS scores (Cox, Holden, & Sagovsky, 1987) and presented non-depressed levels of sensitivity during mother-infant interaction when their babies were 1 year old (Murray et al., 1996). Furthermore, among HIV-infected mothers, infant massage was useful not only to enhance mother-infant interaction, but also to reduce maternal depression and to lower parental stress. Finally, infant massage has been shown to produce several benefits for mother-infant interaction in the case of premature birth too, in terms of less maternal intrusiveness, more social involvement by infants and more reciprocal interaction (Ferber et al., 2005).

Among the non-clinical and not-at-risk population, the results of the benefits of infant massage for mother-infant interaction are controversial. In one study carried out by Lee (2006) with infants aged between 2 and 6 months, after 4 weeks of infant massage mother-infant dyads in the experimental group obtained higher scores on MIPIS (Walker & Thompson, 1982) during playful situations, indicating higher quality of mother-infant interaction compared to the control group. On the contrary, a recent meta-analysis by Bennet, Underdown and Barlow (2013), indicated no differences in mother-infant interaction. Then Underdown, Norwood and Barlow (2013) aimed to find an explanation for these contrasting results by trying to identify which types of dyads are more likely to receive benefits from the infant massage experience. Different qualitative measures (Working Model of the Child Interview, Edinburgh Postnatal Depression Scale, CARE-index for coding videotaped mother-infant interaction) were administered to 39 mother-infant dyads before and after an infant massage session. The authors identified three CMO patterns (context, mechanism and outcome). Firstly, women described as “high risk” did not receive any benefits from the infant massage experience, but, on the contrary, became more intrusive. Secondly, women categorized as “low” risk did not benefit from the treatment either, because of probable “ceiling effects”, indicating that they were already in the right mood. Finally, women

categorized as “moderate” risk appeared to be the most likely to benefit from the treatment.

Currently, still little is known about the effects of infant massage on mother-infant interaction in non-clinical populations.

In the present study a group of mother-infant dyads who received 5 weeks of infant massage training during the second month of the infant's life was compared with a control group of dyads to examine whether the dyads in the target group show any qualitative change in their spontaneous interaction (except for changes due to the increased infant's age) after two months of infant massage experience.

We made the following hypotheses.

1. On the basis of the literature on the development of mother-infant interaction over the first three months of life and the benefits of infant massage for the relationship, we expected an increase of maternal behaviors aimed to stimulate the infant engagement in interaction, given the development of the infant's social abilities in both groups, but a greater change in dyads who experienced infant massage.
2. With regard to the infants, on the basis of the literature on the 2-month-transition, we expected a decrease in time spent in quiet alert state and simple attention in both groups over time, and an increase in more complex and active behaviors. However, due to the regular practice of infant massage, which enhances mother-infant interaction, we expected a higher amount of interactive behavior in infants in the Target Group.
3. In addition, we aimed to investigate whether dyads in the Target Group at 3 months showed different patterns of co-regulation between mother and infant respect to the Control Group, measured in terms of associations between mother and infant behaviors. We hypothesized a richer interaction between mother and infant in the Target Group, developed through a more reciprocal interaction and recognition of infant cues experimented during the infant massage experience.

2. Method

2.1 Participants

Participants were 42 mothers and their full-term infants, 23 males and 19 females, recruited at the “Policlinico G.B. Rossi” Hospital in Verona and the “Sacro Cuore” Hospital in Negrar (Verona) during the first 3 days after the deliver. About 300 mothers were informed about the study; 80 mothers consented to be contacted at the third week of infant's life and 42 of them accepted to participate in this study.

Mothers recruited in the first Hospital ($N=22$) were contacted to take part to a study on infant massage (Target Group); mothers recruited in the second Hospital ($N=20$) were contacted to be involved in a study on the development of mother-infant interaction (Control Group).

Mother-neonate dyads were selected on the basis of (a) absence of obstetrical and neurological complications (no particular medication during pregnancy and delivery; full term delivery, normal birth weight, above 2,500 g), (b) absence of medical indications or physical or psychological disease on the part of the mothers, (c) the mother's age being above 20 and under 40 years and both the mother and father being Italian. In the Target Group, gestational age was 39 weeks ($SD=0.77$), weight at birth 3.251 ($SD=0.26$); 20 infants were born with natural delivery, 2 with caesarian; maternal age was 31.27 ($SD=2.93$) and the years of education were 16.54 ($SD=4.74$); twenty out of 22 infants were initially breast fed. In the Control group, gestational age was 39.27 ($SD= 0.90$), weight at birth 3.147 ($SD=0.45$). Maternal age was 34 ($SD=3.52$), and the years of education were 15.36 ($SD= 3.52$). Nineteen out of 20 infants were initially breast-fed.

Mothers' and infants' characteristic are detailed in Table 1 and Table 2, respectively.

Table 1. *Maternal characteristics*

	Target ($n=22$)		Control ($n=20$)	
	M	SD	M	SD
Age	31.27	2.93	34.00	3.52
Years of education	16.54	4.74	15.36	2.37
Breast-feeding at 1 month	20		19	
Bottle-feeding at 1 month	2		1	

Table 2. *Infant's characteristics*

	Target (<i>n</i> =20)		Control (<i>n</i> =20)	
	M	SD	M	SD
Females	11		9	
Males	11		11	
Weeks at birth	39	0.77	39.27	0.90
Weight at birth	3.25	0.26	3.147	0.45

2.2 Procedure

In the third week of the infant's life, the mothers who agreed to be called back were contacted by the researcher. Dyads who were willing to participate were visited at home by the researcher when the infant was 1 month old; during this visit, the mother and infant were videotaped during 5 minutes of spontaneous face-to-face interaction; more details are described in the *Videotaping* section.

From the following week, only dyads in the Target Group received 5 weeks of infant massage training at home; the one-to-one modality was preferred to group training in order to allow the mother to attend every lesson and accommodate all of the mother's needs.

When the infants were 3 months old, another videotaping of spontaneous face-to-face interaction was made with dyads in both groups.

2.3 Videotaping

To assess any changes in mother-infant interaction, dyads were videotaped in the natural context of their home when the infants were 1 and 3 months old during 5

minutes of spontaneous face-to-face interaction. The mothers were asked to behave with their infants as they would during normal interaction. The requisite for the infant to start the videotaping session was a quiet alert state.

The infant was placed over some pillows on the sofa in a semi-reclined position with the mother seated nearby, about 30 cm away, in a face-to-face position.

A video camera positioned on a tripod about 2 meters away recorded the infant's face and body, as well as the mother's face, reflected in a mirror positioned behind the infant's back.

2.4 Type of intervention

A certified IAIM instructor provided 5 weeks of infant massage training with every dyad in the Target Group between the first and second month of the infant's life.

The IAIM program, developed by Vimala McClure (1983), is a set of different techniques including yoga, Indian and Swedish practices and McClure's self-developed techniques. The massage includes different types of tactile stimulation such as caresses, squeezing of arms and legs, gentle pressure and some kinesthetic stimulation such as flexion and extension of arms and legs. Every week, mothers learned how to massage different zones of their infant's body: feet and legs in the first week; tummy and chest in the second; arms and face in the third; back in the fourth; the last week was dedicated to teaching some playful and yoga movements to mobilize the infant's legs and arms. Mothers were asked to massage their infant once a day if possible, and when this was not feasible, no less than 4-5 days a week.

The fundamental indication to start massage was the active or quiet alert state of the infant; mothers were instructed to read their infant's signals of willingness such as bright eyes, quiet alert state, eye contact, and signs of unwillingness such as pre-sleeping state and fussy or clumsy movements. The length of every massage session was determined by the infant's willingness to receive tactile stimulation.

2.5 Coding

A modified version of the mother-infant face-to-face communication coding scheme (Lavelli & Fogel, 2013) was used to code the videos. Only the first 3 minutes were analyzed. The coding scheme includes seven categories for infant behaviors and six for maternal behaviors. Infant behaviors were coded on the basis of gaze direction and expressive configurations in seven mutually exclusive categories: five including gazing

at the mother's face, with Simple attention, Concentrated attention, Excited attention, Smiling, and Cooning; two including gazing elsewhere (not at the mother's face) in a Quiet alert state and in a Fussy/crying state. We added this last category, which was not present in Lavelli & Fogel's original version.

Maternal behaviors were coded on the basis of their relational interactive quality into six mutually exclusive categories: Following, Affectionate talking, Stimulating, Mirroring, Demanding, and Disrupting.

See Table 3 and Table 4.

Table 3. *Infant joint states of gaze direction + expressive configurations during face-to-face interaction with her mother*

Infant Behaviors	Description
Gaze elsewhere in quiet alert state	The infant is gazing elsewhere from the mother’s face, regardless of her or his gazing direction and expressive configuration.
Gaze elsewhere in a fussy/crying state	The infant is gazing elsewhere from the mother’s face, regardless of her or his gazing direction and expressive configuration in a fussy/crying state
Simple attention	The infant is gazing at the mother’s face with no particular facial action, except for reflexes and vegetative neonate movements (rooting, occipito-frontalis reflex, startle, chin tremble, “munchies”, yawning, hiccup, jaw dropping).
Concentrated attention	The infant is gazing at the mother’s face with high-arousal and sustained visual attention indexed by brow knitting and motor activity quiet.
Excited attention	The infant is gazing at the mother’s face with high arousal and sustained visual attention indexed by brow raising and fast brow-raising, accompanied by motor excitement, including fast limb movements.
Smile	The infant is gazing at the mother’s face and smiling at her.
Cooing	The infant is gazing at the mother’s face with approaching expression: lip shaping for cooing, with upper lip raising and protruding, or mouth position for forming speech-like sounds, either with or without actual vocalizing.

Maternal behaviors	Description	Example
Following	The infant is gazing elsewhere, sometimes glancing up the mother's face without expressing any sign of. The mother is simply gazing at the infant (i.e., following the infant's behavior), mainly inactive with neutral expression but sometimes smiling or laughing, and/ engagement or reacting to specific infant actions (i.e., burst of motor excitement, eye widening, shifting of the head and gaze toward the mother's face, brown knitting, crying) by a verbal comments on the infant's action, exclamations of pleasure for the established visual contact in a glance, shooting reaction. Mother doesn't touch the infant.	Mother gazes at the infant with absent-minded expression. Mother comments in a quiet way: "Another slap" to the infant who has just hit her in face again; "Oh my God, a hiccup... it's a big hiccup!" to the infant who has hiccup.
Affectionate talking	Mother is talking to the infant in a affectionate way; she may smile or showing exaggerated facial expressions and use long phrases and/or simple repeated words. Sometimes maternal sentences are accompanied by gentle tactile stimulation (e.g., mother caresses the infant's chest with her finger).	Mother says affectionately to the infant "Your eyes are blue, let's hope they remain blue, as your grandfather's eyes..."
Stimulating	The mother introduces a new playful stimulus (tactile and/or vocal or motor) that can give rise to a new interactive sequence or get and/or maintain the infant's attention.	Mother softly pushes the infant's tummy with her finger, singing at the rhythm of her movements "ton ton ton ton ton ton". Mother calls the infant's name in a soft tone of voice repeatedly, showing a clear intention of getting the infant's attention.
Mirroring	Mother is mirroring an infant's facial and/or vocal and/or body action (vocalization, smile, brow raising, brow knitting, mouth opening and lip protrusion for pre-speech movements), yawn, arm movement, etc.) either by imitating it quite literally or with particular emphasis or by reproducing the affective quality (i.e., rhythm, affective contour, intensity) of the infant action through modalities of communication that differ from those used by the infant. Maternal mirroring may be accompanied by a smile and/or an encouragement or a supportive comment on the infant's action.	During a face-to-face protoconversation the infant vocalizes " <i>nghe</i> "; the mother, smiling at the infant, repeats the vocalization reproducing its characteristics (same syllabic sound, intonation, accent, intensity). The infant is moving her arm un and down in a rhythmic and excited way; the mother, smiling at infant, accompanies the infant's movements with a vocalization, "Hop-hop, hop-hop", that reproduces the same rhythm and the upward-downward tone of the infant's arm movements.
Demanding	Mother is asking the infant repeatedly and insistently to do something different from her or his current behavior. Maternal request may be expressed in different ways: mother can either reproduce a previous infant's vocalization or facial expression or introduce a new facial or vocal action, asking the infant to repeat it through a peremptory and/or pressing tone of voice. Maternal request may also be accompanied by an intrusive maternal action, but without eliciting any	Mother reproduces an infant's vocalization repeatedly and insistently, asking the infant to repeat it: " <i>Ngheè...come on, say ngheè to your mom, say ngheè...</i> "
Disrupting	The mother's action is either interfering with the infant's activity or disrupting it, attempting to impose a different action or position on the infant; the infant shows signs of discomfort or active resistance and/or protest.	The infant is gazing at the mother- who is talking to him- sucking his hand; when the mother takes the infant's hand away from the mouth with force, the infant tries to take it again to his mouth; thus the mother restrains the infant's hand by her own hand.

2.6 Reliability

The videotaped sessions of mother-infant interaction were coded by 4 coders blind to the aims of the study, 2 for infants' behaviors and 2 for mothers' behaviors. Inter-coder reliability was calculated using 20 videos (25% of the videotaped sessions) randomly selected. For infant behaviors the average Cohen's Kappa was .84. For maternal behaviors the average Cohen's Kappa was .87.

3. Results

In our sample, both groups were matched for maternal characteristics (age, years of education, type of feeding) and infant characteristics (sex, weight and gestational age at birth). Maternal age and years of education, and infant weight at birth were then compared and no significant differences were found between the groups.

3.1 Maternal behaviors

Descriptive data for maternal behaviors are reported in Table 5.

Table 5. Mean durations (in seconds) of maternal behaviors during 3 min mother-infant face-to-face interaction

Maternal Behavior	Target Group				Control Group			
	1 month		3 months		1 month		3 months	
	M	SD	M	SD	M	SD	M	SD
Following	111.36	38.55	51.36	39.40	66.84	30.47	59.89	24.50
Affectionate Talking	49.19	37.84	70.27	42.63	97.47	33.96	92.63	30.12
Stimulating	14.82	16.7	46.27	32.4	10.16	15.29	23.37	19.41
Mirroring	3.91	4.33	9.18	13.58	3.95	4.71	4.32	4.88
Demanding	-	-	-	-	-	-	-	-
Disrupting	-	-	-	-	-	-	-	-
Not codable	0.72	-	2.92	-	1.58	-	-	-

First, because of wide interdyad differences, as well as wide differences of values according to categories, we transformed all maternal behavioral data in *Z*-scores in order to have comparable data. Then, in order to check if data were normally distributed, we applied the Shapiro–Wilk test. Not all *p*-values were greater than the chosen alpha level (0.05). Consequently, we used the Kruskal-Wallis analysis of variance for non-parametric data with all behaviors shown by mothers in the two groups at 1 month and 3 months, in order to check globally the presence of differences according to the interaction between time, behavioral categories, and group. The analysis revealed a statistically significant difference, $\chi^2 = 72.074$, $df = 15$, $p < .05$. Then, we conducted pairwise Wilcoxon and Mann-Whitney corrected tests as post hoc test to assess any significant difference within group from 1 to 3 months, and between groups at these two times, respectively, for each category of maternal behavior.

We excluded from analysis categories of maternal Demanding and Disrupting, due to the absence of these behaviors in our sample.

The Mann-Whitney corrected test showed significant differences between groups at 1 month, that is, before the infant massage experience, in maternal Following, significantly higher in the Target Group ($p < .001$), and Affectionate talking that, instead, was significantly higher in the Control Group ($p < .001$). However, these differences were not found any more at 3 months, because only mothers in the Target group showed a significant decrease in Following the infant's behavior, as revealed by the Wilcoxon test ($p < .001$) (see Fig. 1), and, vice versa, an increase in Affectionate talking, although with no significant difference, between 1 and 3 months (see Fig. 2). Differently, in the Control group maternal Following and Affectionate Talking remained quite stable over time.

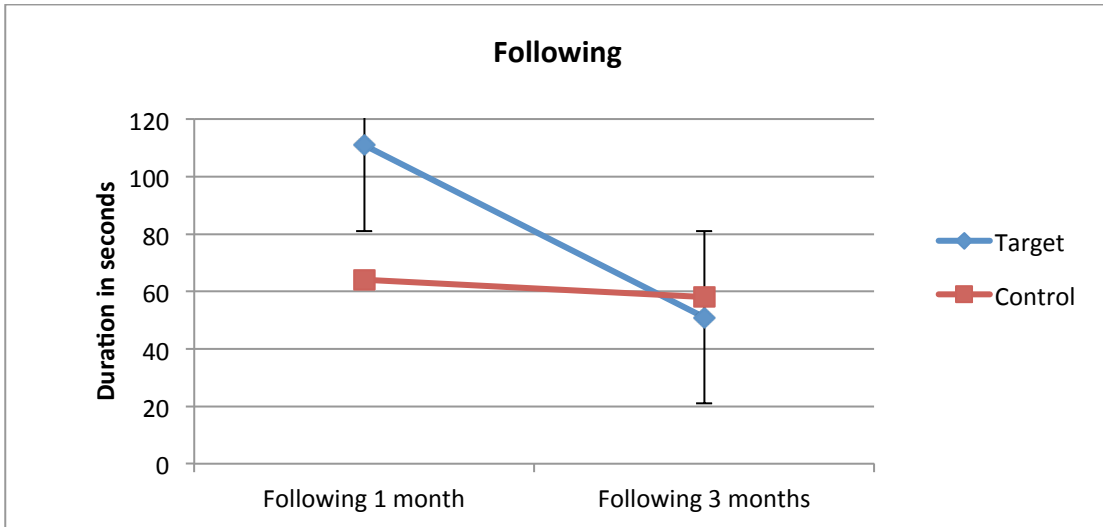


Figure 1. Maternal Following

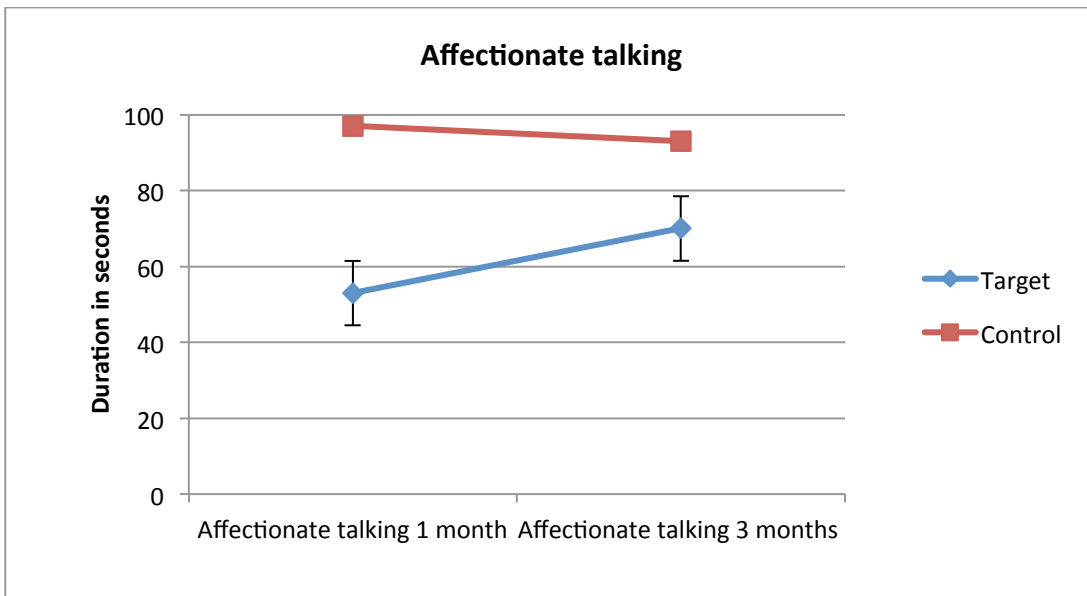


Figure 2. Maternal Affectionate talking

Durations of maternal Stimulating were similar in Target and Control groups at 1 month, but increased significantly ($p < .001$) only in the Target group at 3 months (see Fig. 3).

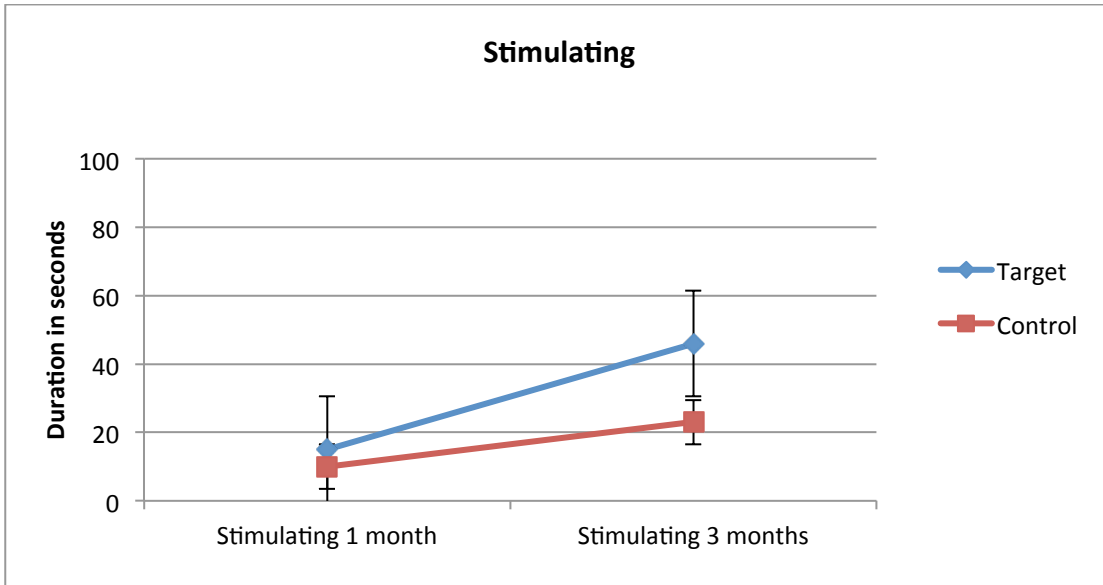


Figure 3. Maternal Stimulating

Finally, maternal Mirroring – that unexpectedly was very low in both groups – increased from 1 to 3 months only in the Target group, although no significant differences were found within group and between groups (see Fig. 4).

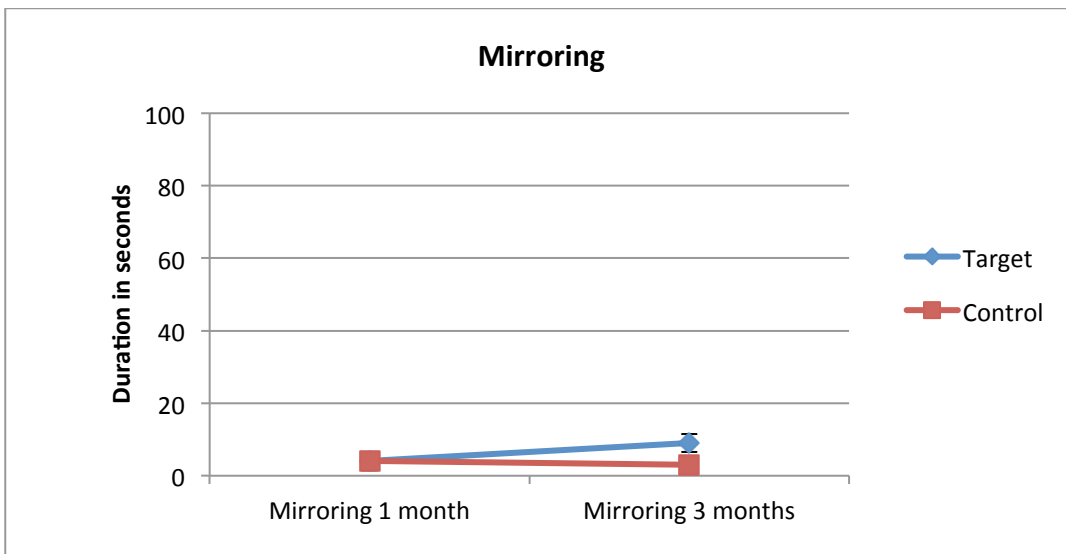


Figure 4. Maternal Mirroring

On the whole, these results showed that maternal behaviors addressed to the infant during interaction changed significantly from 1 to 3 months in mothers who had the experience of infant massage, but remained quite stable in the other mothers.

3.2 Infant Behaviors

Descriptive data for maternal behaviors are reported in Table 6.

Table 6. Mean durations (in seconds) of infant behaviors (joint states of gaze direction + expressive configuration) during 3 min mother-infant face-to-face interaction

Infant Behavior	Target Group				Control Group			
	1 month		3 months		1 month		3 months	
	M	SD	M	SD	M	SD	M	SD
Gaze elsewhere:								
Quiet Alert State	88.45	56.3	70.82	62.46	87.68	51.94	89.95	50.86
Fussy/ Crying	15.64	21.41	2.91	6.63	11.26	18.75	4.79	10.03
Attention:								
Simple	33.95	36.56	12.68	15.63	47.58	40.53	14.84	10.16
Concentrated	27.23	34.13	40.05	41.84	27.37	31.19	32.00	29.64
Excited	0	0	9.09	15.67	0.63	2.75	15.58	25.40
Smile	6.27	10.68	24.45	33.2	2.05	3.78	14.42	16.53
Cooing	3.27	4.41	17.50	23.52	0.84	2.12	6.74	14.31
Not codable	5.19	-	2,5	-	2.59	-	1.68	-

First, because of wide interdyad differences, as well as wide differences of values according to categories, we transformed all infant behavioral data in Z-scores in order to have comparable data. Then, in order to check if data were normally distributed, we applied the Shapiro–Wilk test. Not all p -values were greater than the chosen alpha level (0.05). Consequently, we used the Kruskal-Wallis analysis of variance for non-parametric data with all behaviors shown by infants in the two groups at 1 month and 3 months, in order to check globally the presence of differences according to the interaction between time, behavioral categories, and group. The analysis revealed a statistically significant difference, $\chi^2 = 67.062$, $df = 27$, $p < .05$. Then, we conducted pairwise Wilcoxon and Mann-Whitney corrected tests as post hoc test to assess any significant difference within group from 1 to 3 months, and between groups at these two times, respectively, for each category of infant behavior.

The analyses showed that at 1 month infants in both groups spent more than half of the session time gazing elsewhere (i.e., not at the mother’s face) in Quiet alert state, but that from 1 month to 3 months durations of Gaze off decreased – though not significantly – only in the Target group (see Fig. 5). The time spent in Fussy/crying state by infants in both groups was quite short at 1 month and almost absent at 3 (see Fig. 6). No significant differences were found between the two groups.

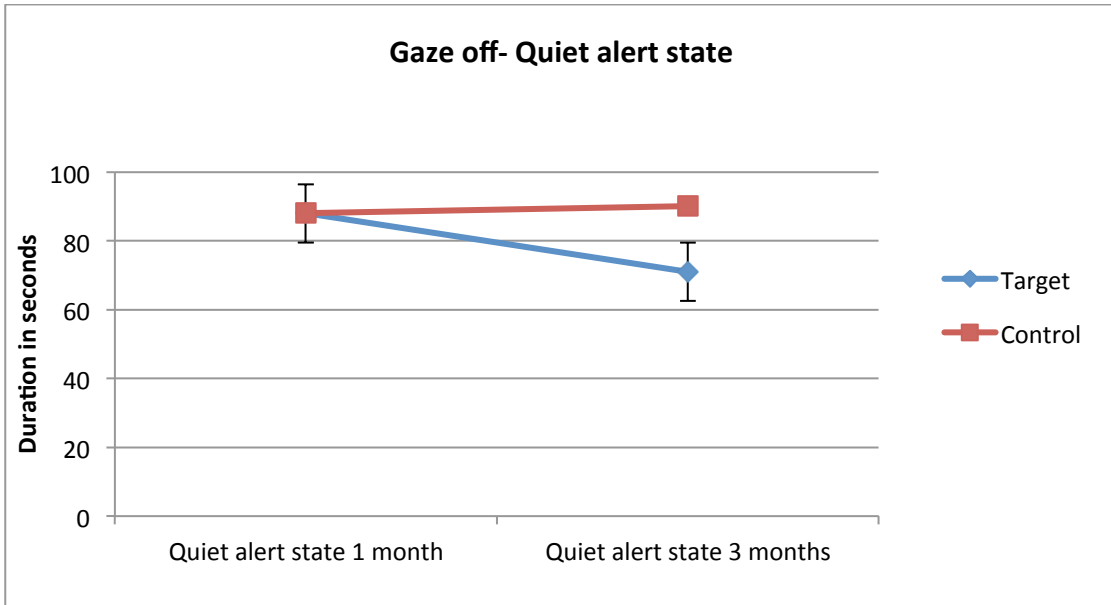


Figure 5. Infant Gaze off- Quiet alert state

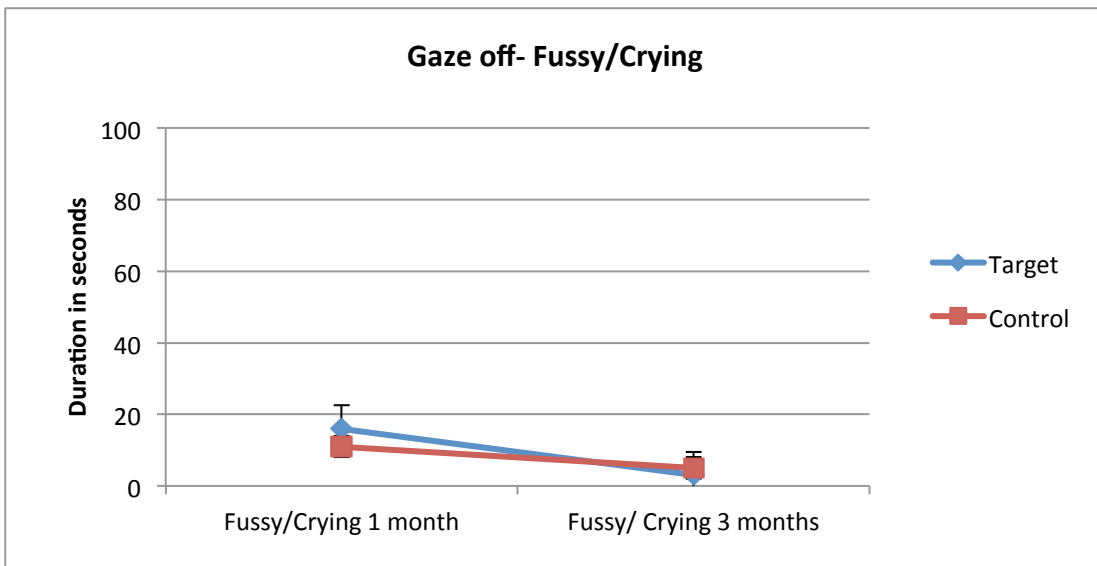


Figure 6. Infant Gaze off- Fussy/crying

As expected, infants in both groups showed main changes in their social behaviors from 1 to 3 months. In both groups Simple attention, that is, simple gazing at the mother's face with neutral expression, decreased with the increase of more active forms of attention, such as Concentrated attention and Excited attention, although only Excited attention increased significantly at 3 months ($p < .001$ for both Target and Control group) (see Fig. 7, 8, and 9). No significant differences were found between the groups.

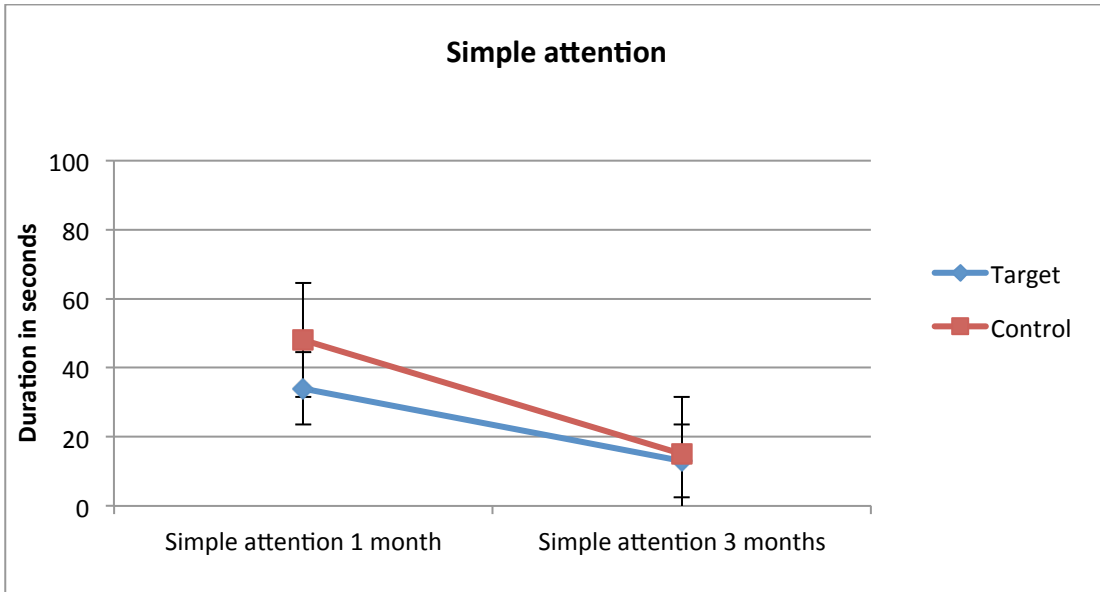


Figure 7. Infant Simple attention

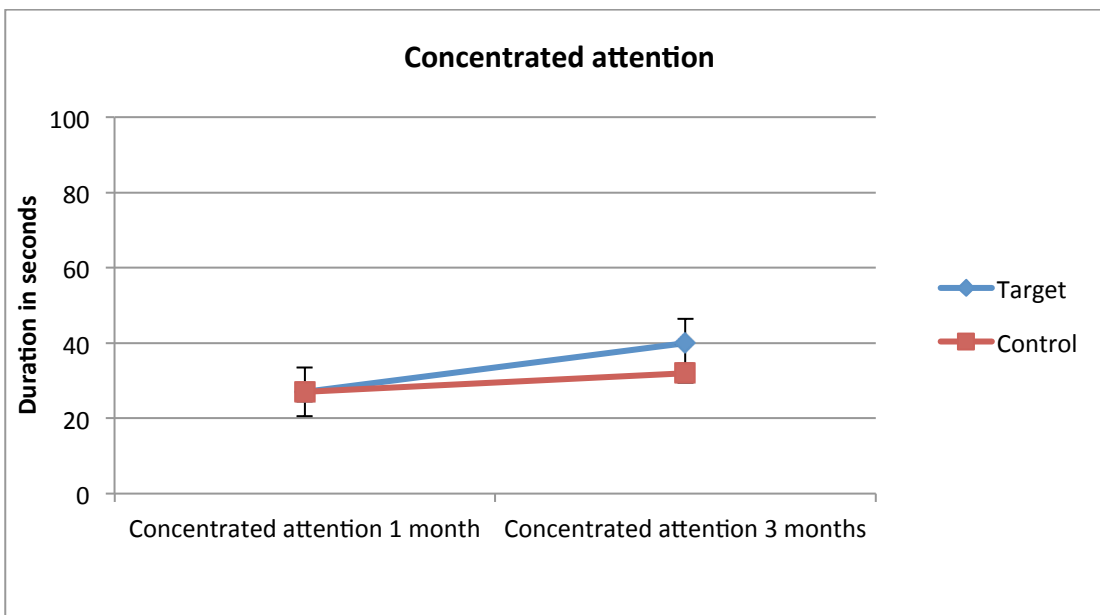


Figure 8. Infant Concentrated Attention

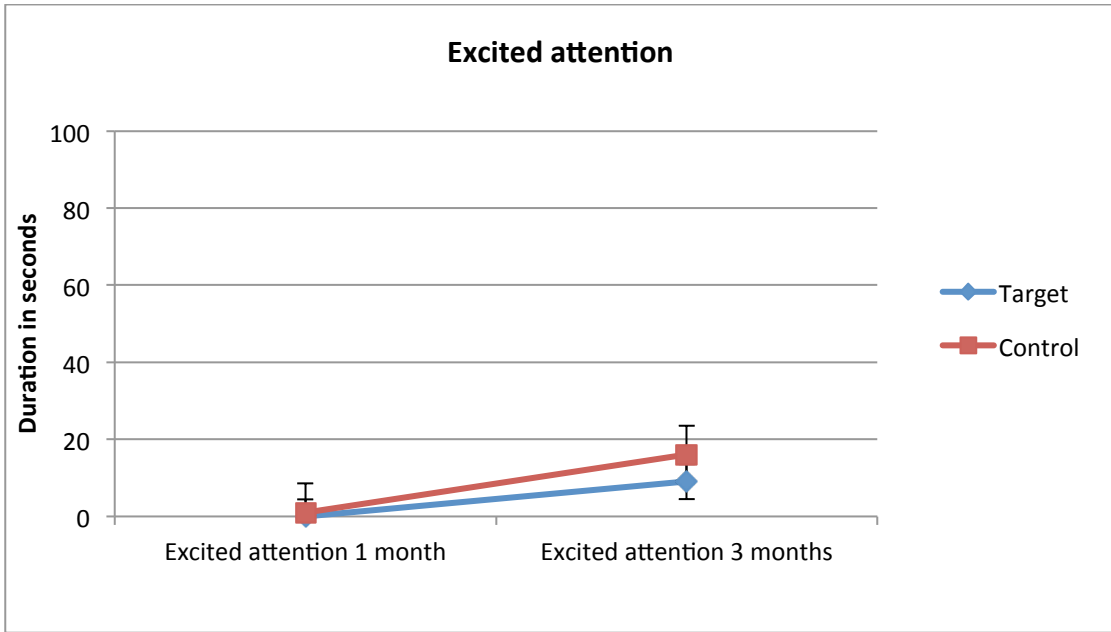


Figure 9. Infant Excited attention

As expected, also the infant's Smiling at the mother's face increased significantly from 1 to 3 months in both Target Group ($p = 0.02$) and Control Group ($p < .001$), but no significant differences were found between the groups (see Fig. 10).

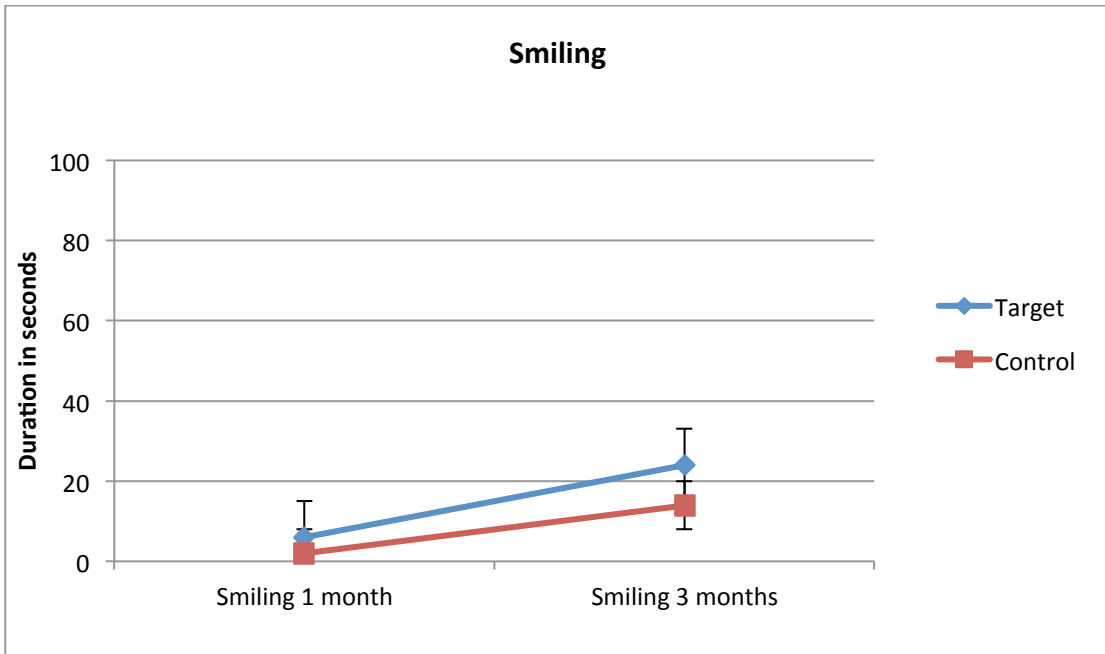


Figure 10. Infant Smiling

On the contrary, the infant's Cooing at the mother's face increased almost significantly ($p = 0.05$) only in the Target group (see Fig. 11). The differences in Cooing durations between the groups did not reach the level of statistical significance.

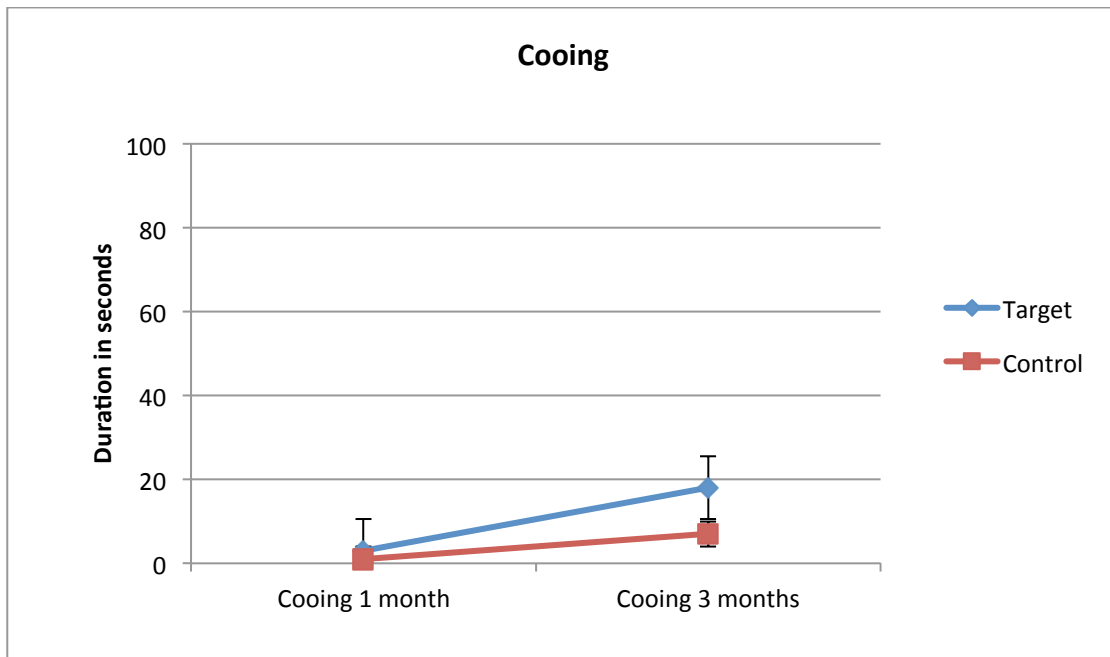


Figure 11. Infant Cooing

3.3 Sequential analysis of mother-infant interaction

A sequential analysis (Generalized Sequential Querier; Bakeman & Quera, 1995) was performed on the infant's behaviors as *target* and maternal behaviors as *given*, and vice versa, to assess any significant transitional probability between maternal and infant behaviors during face-to-face communication, considering the mean values of each group for each observation. The significance of transitional probabilities was assessed by the adjusted residuals statistic (Bakeman & Quera, 1995).

Figure 12 synthesizes and compares the real-time transitional probabilities between maternal and infant behaviors found to be significant for each group at 1 month and 3 months. At 1 month, the presence of maternal Affectionate talking with high-pitched voice significantly affected the occurrences of infant Concentrate attention in the Target group, and infant Simple attention in the Control group; in the Target group, the infant Concentrate attention, conversely, contributed to maintain maternal Affectionate talking, in a bidirectional sequential pattern of dyadic communication. Only in the Target group maternal Affectionate talking was elicited by the emergence of the very first infant Smiles. Figure 12 also shows that other two bidirectional sequential pattern of behaviors – between infant Gaze off in Quiet alert state and, respectively, maternal

Following (i.e., simply gazing at the infant), or maternal Stimulating to get the infant's attention – were found to be significant at both 1 and 3 months for the Target group, and the Control group too limited to the link between maternal Stimulating and infant Gaze off.

At 3 months, in both groups the infant Cooing played a main role in affecting the occurrence of maternal Affectionate Talking which, in turn, elicited infant's Concentrated attention. However, only in the Target group another significant link between maternal sensitive behavior and infant expression of positive affect was found, namely, an association between maternal Mirroring and infant Smiling.

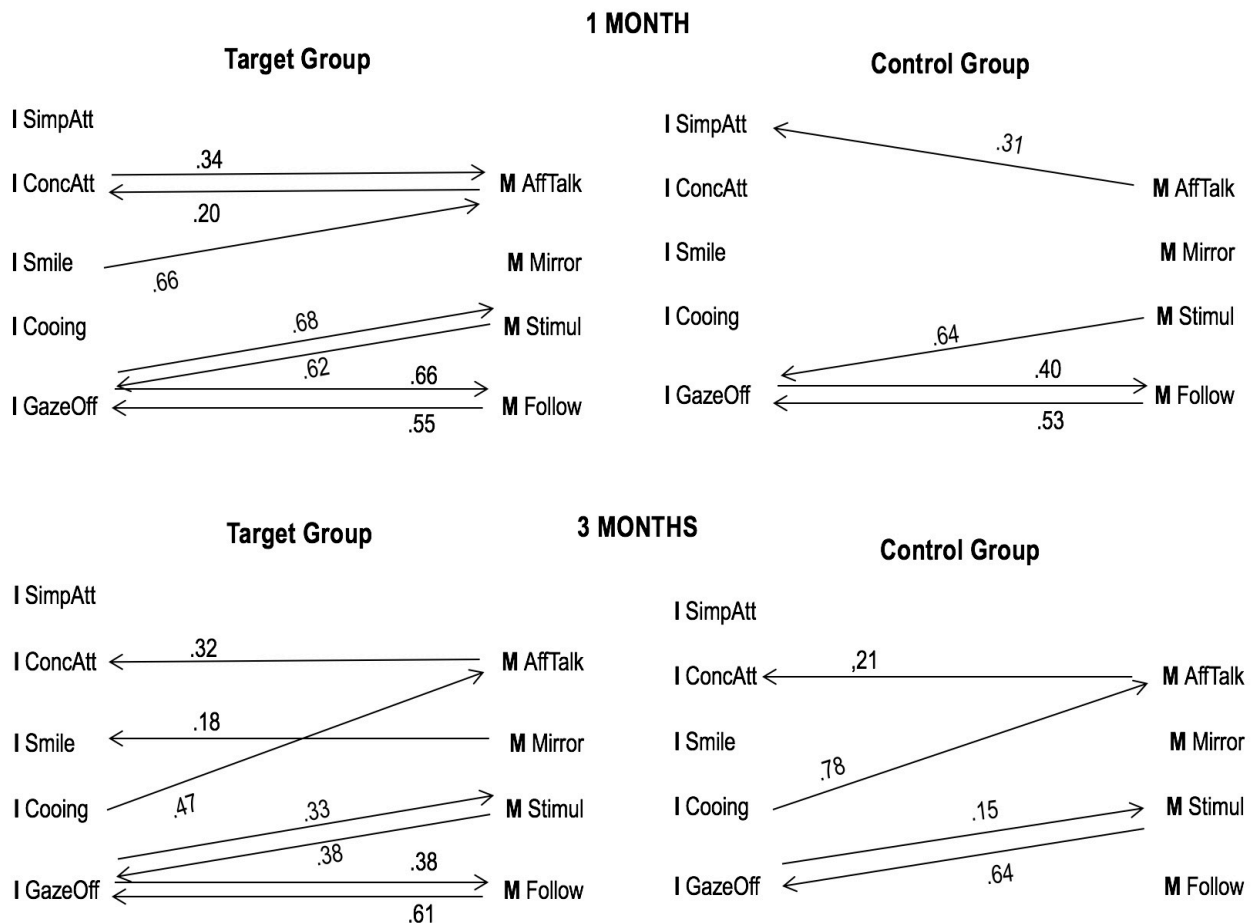


Figure 12. Mean transitional probabilities between maternal and infant's behaviors during mother-infant face-to-face communication. Only transitional probabilities found to be significant are included. I = infant; M = mother; SimpAtt = Simple attention; ConcAtt = Concentrate attention; GazeOff = Gaze Elsewhere- Quiet Alert State; AffTalk = Affectionate talking; Mirror = Mirroring; Stimul = Stimulating; Follow = Following

4. Discussion

In this study, we aimed to examine the possible impact of infant massage in the early stages of life on the quality of mother-infant interaction. 22 dyads involved in an infant massage experience (Target Group) were compared to 20 dyads with similar characteristics with no experience of infant massage or other specific forms of tactile communication (Control Group). We expected infants in both groups to show an increase in social and active behaviors (i.e. concentrated and excited attention, smiling, cooing) from 1 to 3 months, as reported by Lavelli and Fogel (2013), due to typical developmental trajectories across the 2-month-developmental transition.

In our sample, infants in both groups showed similar developmental trajectories of communicative behaviors, but in infants who received infant massage (almost daily for two months) some behaviors lasted for different amounts of time during mother-infant face-to-face interaction. Specifically, we found a significant increase in Cooing among infants in the Target Group. It is important to notice that these mouth movements, produced when infants are in a quiet alert or playful state, are frequently associated with vocalizations of positive affect (Trevarthen, 2013), which elicit an emotional and motivated response from the caregiver. In particular, the mother tends to interpret this kind of vocalization as intentional (Beaumont and Bloom, 1993), initiating a mutually regulated “conversation” characterized by turn-taking, recognition of the infant’s emotions by mothers and adaptation of their responses (Gratier et al, 2015). These early vocal exchanges encourage vocal and verbal feedback, which may also have an impact on language acquisition (Lavelli & Fogel, 2005).

Infant behaviors were regulated and regulated the mother's behaviors in mutual communication: the mothers' behavior, on the other hand, showed a significant increase in Stimulating behaviors in the Target Group, indicating the mother’s intention to attract or maintain the infant’s attention during interaction, often through tactile playful stimuli. In this regard, it is important to notice that Stimulating behavior excluded all demanding or disrupting attempts to attract the infant's attention, so we could imagine a positive or unbothered reaction from the baby, even if it is known that infants tend to shift the direction of their gaze away from their mother's face when they have “enough” stimulation, to recover from the excitement (Lavelli & Fogel, 2013).

Also Mirroring and Affectionate talking behaviors increased with time in the Target Group, although the difference did not reach the significance level. In a complementary

way, the simple Following the infant's behavior without touching or talking to her decreased from 1 to 3 months in the Target group, while it remained quite stable – as the other maternal behaviors – in the Control group.

In the whole, these findings suggest that at 3 months the mother-infant dyads who had the experience of infant massage interacted more actively and mutually than dyads in the control group. This interpretation is supported by results from sequential analysis, which showed a higher number of significant associations between mothers' and infants' behaviors, that is, a richer interaction in the Target Group than in the Control Group, mostly between maternal Mirroring and infant Smile, and infant Cooing and maternal Affectionate Talking. In addition, we found a significant association between Fussy/crying behavior and Affectionate Talking, indicating the presence of a sensitive maternal behavior when the infant was not in a quiet or attentive state.

In the Control group we found a lower number of significant associations: however, these results do not seem to indicate a poor interaction between mothers and infants, but a high variability within group, while in dyads who shared the same experience of infant massage, patterns of co-regulation were more stable.

The presence in both groups of the association between maternal stimulation and the infant's gaze away from the mother's face is well documented by literature (Lavelli & Fogel, 2013); in our revised coding system we made the distinction between “gaze at the mother's face in a quiet alert state” and “gaze at the mother's face in a fussy/crying state”, so, we could be sure that infant, even if was not looking at the mother, was in a comfortable state.

It is well-known that infants learn about themselves through interaction with other people, in particular their caregiver, and that mutual regulation in early mother-infant interaction is fundamental for cognitive (Feldman, Greenbaum, Yirmiya, & Mayes, 1996; Papousek & Papousek, 1987; Tamis-LeMonda & Bornstein, 1989) socio-emotional and linguistic development (Ainsworth, Bell, & Stayton, 1974; Bakeman & Brown, 1980; Emde, 1991; Kochanska, Forman, & Coy, 1999, Bruner, 1983). Furthermore, attuned mutual regulation derives from the mother's sensitive ability to maintain infant attention, positive affect, tone of voice and an appropriate reaction to the infant's cues (Landry, Smith, Miller-Loncar, & Swank, 1998; Legerstee & Varghese, 2001).

Infant massage could be a modality to promote mother-infant interaction due to specific messages that are conveyed through maternal touch and a deeper recognition of infant cues and behaviors.

5. References

Ainsworth, M. D. S., Bell, S. M., & Stayton, D. J. (1974). Infant–mother attachment and social development: ‘Socialization’ as a product of reciprocal responsiveness to signals. In M. P. M. Richards (ed.), *The integration of a child into a social world* (pp. 99–135). Cambridge, UK: Cambridge University Press.

Bruner, J. (1983). *Child’s talk: Learning to use language*. London: Norton.

Darmstadt, G., Samir, K., & Saha (2002). Traditional practice of oil massage of neonates in Bangladesh. *Journal of Health, Population and Nutrition*, 20 (2), 84-88.

Emde, R. N. (1991). Positive emotions for psychoanalytic theory: Surprises from infancy research and new direction. *Journal of the American Psychoanalytic Association*, 39 (Suppl.), 5–44.

Emde, R. N., & Buchsbaum, H. K. (1989). Toward a psychoanalytic theory of affect: II. emotional development and signaling in infancy. In S. I. Greenspan & G. H. Pollock (eds.), *The course of life* (2nd ed., pp.193–227). Madison, CT: International Universities Press.

Emde, R. N., Gaensbauer, T. J., & Harmon, R. J. (1976). Emotional expression in infancy: A biobehavioral study. *Psychological Issues (Monograph 37)*. New York: International Universities Press

Feldman, R., Greenbaum, C. W., Yirmiya, N., & Mayes, L. C. (1996). Relations between cyclicity and regulation in mother–infant interaction at 3 and 9 months and cognition at 2 years. Paper presented at the 10th International Conference on Infant Studies, Providence, Rhode Island.

Feldman, R. (2011). Maternal touch and the developing infant. In M. J. Hertenstein, & S. J. Weiss (eds.), *The handbook of touch: Neuroscience, behavior, and health perspective* (pp. 373–407). NY: Springer.

- Ferber S. G., Laudon, M, Kuint, J, Weller, A, & Zisapel, N. (2002). Massage therapy by mothers enhances the adjustment of circadian rhythms to the nocturnal period in full-term infants. *Developmental and Behavioral Pediatrics*, 23(6),410–5
- Field, T., Grizzle, N., Scafidi, F., Abrams, S., Richardson, S., Kuhn,C., et al. (1996). Massage therapy for infants of depressed mothers. *Infant Behaviors and Development*, 19, 107-112.
- Field, T., Hernandez-Reif, M., Diego, M., Feijo, L., Vera, Y., & Gil, K. (2004). Massage therapy by parents improves early growth and development. *Infant Behavior and Development*, 27(4), 435-442.
- Fogel, A., Dedo, J. Y., & McEwen, I. (1992). Effect of postural position on the duration of gaze at mother during face-to-face interaction in 3-to-6-month-old infants. *Infant Behavior and Development*, 15, 231–244.
- Fogel, A. (1993). *Developing through relationships: Origins of communication, self, and culture*. Chicago: University of Chicago Press.
- Fogel, A. (2001). A relational perspective on the development of self and emotion. In H. A. Bosma & S. Kunnen (eds.), *Identity and emotion: Development through self-organization* (pp. 93–114). New York: Cambridge University Press.
- Fogel, A., Garvey, A., Hsu, H., & West-Stroming, D. (2006). Change processes in relationships. A relational-historical approach. Cambridge, UK: Cambridge University Press.
- Fogel, A., & Thelen, &. (1987). Development of early expressive and communicative action: Reinterpreting the evidence from a dynamic systems perspective. *Developmental Psychology*, 23, 747–761.
- Gurol, A., & Polat, S., (2012). The effects of Baby Massage on attachment between mother and their infants. *Asian Nursing Research* 6 (1), 35-41.
- Hertenstein, M. (2002). Touch: Its communicative functions in Infancy. *Human Development*, 45, 70-94.
- Hsu, H., & Fogel, A. (2003). Social regulatory effect of infant nondistress vocalization on maternal behavior. *Developmental Psychology*, 39, 976–991.

Jean, A. D. L., & Stack, D.M. (2012). Full term and very-low-birth-weight preterm infants' self regulation behaviors during a Still-Face interaction: Influence of maternal touch. *Infant Behavior and Development*, *35*, 779-791.

Kaye, K. (1982). *The mental and social life of babies: How parents create persons*. Chicago: University of Chicago Press

Kochanska, G., Forman, D. R., & Coy, K. C. (1999). Implications of the mother-child relationship in infancy for socialization in the second year of life. *Infant Behavior and Development*, *22*, 249-265.

Lavelli, M., & Poli, M. D. (1998). early mother-infant interaction during breast- and bottle-feeding. *Infant Behavior and Development*, *21*, 667-684.

Legerstee, M., Pomerlau, A., Malcuit, G., & Feider, H. (1987). The development of infants' responses to people and a doll: Implications for research in communication. *Infant Behavior and Development*, *10*, 81-95.

Legerstee M., Markova G. (2007). Intentions make a difference: infant responses to still-face and modified still-face conditions. *Infant Behavior and Development* *30*, 232-250.

Lewis, M. (1972). State as an infant-environment interaction: An analysis of mother-infant interaction as a function of sex. *Merrill-Palmer Quarterly*, *18*, 95-121.

Meltzoff, A. N. (1994, April). Representation of persons: A bridge between infants' understanding of people and things. Paper presented at the 9th International Conference on Infant Studies, Paris.

Murray, L., & Trevarthen, C. (1986). The infant's role in mother-infant communications. *Journal of Child Language*, *13*, 15-29.

O'Higgins, M., St. James Roberts, I., & Glover V. (2008). Postnatal depression and mother infant outcomes after infant massage. *Infant Behavior and Development* *109*(1-2), 189-192.

Papousek, H., & Papousek, M. (1987). Intuitive parenting: A dialectic counterpart to the infant's integrative competence. In J. Osofsky (ed.), *Handbook of infant development* (2nd ed., pp. 669-720). New York: Wiley.

Pelaez-Nogueras, M., Gewirtz, J. L., Field, T. M., Cigales, M., Malphurs, J. E., Clasky, S., & Sanchez, A. (1996). Infants' preference for touch stimulation in face-to-face interactions. *Journal of Applied Developmental Psychology, 17*, 199–213.

Purpura, G., Tinelli, F., Bargagna, S., Bozza, M., Bastani, L., Cioni, G. (2014). Effect of early multisensory massage intervention on visual functions in infants with down syndrome. *Early Human Development, 90* (12), 809-813

Reddy, V., Hay, D., Murray, L., & Trevarthen, C. (1997). Communication in infancy: Mutual regulation of affect and attention. In G. Bremner, A. Slater, & G. Butterworth (eds.), *Infant development: Recent advances* (pp. 247–273). Hove, England: Psychology Press.

Scafidi, F.A., Field, T.M., Schanberg, S.M., Bauer, C.R., Tucci, K., Roberts, J., Morrow, C., & Kuhn, C. M. (1990). Massage simulates growth in preterm infants: A replication. *Infant Behavior and Development, 13*, 167-188.

Stack, D. M. (2010). Touch and physical contact during infancy: Discovering the richness of the forgotten sense. In J. Gavin Bremner, & T. D. Wachs (Series eds.), *Wiley-Blackwell handbook of infancy development: Vol. 1. (2nd ed., Vol. 1, pp. 535–567)*. England: Basic Processes.

Stack, D.M., & Muir, D.W. (1992). Adult tactile stimulation during face-to-face interactions modulates five-month olds' affect and attention. *Child Development, 63*, 1509–1525.

Stern, D. N. (1985). *The interpersonal world of the infant*. New York: Basic Books.

Stern, D. N., Hofer, L., Haft, W., & Dore, J. (1985). Affect attunement: The sharing of feeling states between mother and infant by means of intermodal fluency. In T. Field & N. Fox (eds.), *Social perception in infants* (pp. 249–268). Norwood, NJ: Ablex.

Tamis-LeMonda, C. S., & Bornstein, M. H. (1989). Habituation and maternal encouragement of attention in infancy as predictors of toddler language, play, and representational competence. *Child Development, 60*, 738–751.

Trevarthen, C. (1979). Communication and cooperation in early infancy: A description of primary intersubjectivity. In M. Bullowa (ed.), *Before speech: The beginning of interpersonal communication* (pp. 321–347). New York: Cambridge University Press

Trevarthen, C. (1993). The functions of emotions in early infant communication and development. In J. Nadel & L. Camaioni (eds.), *New perspectives in early communicative development* (pp. 48–81). London: Routledge.

Trevarthen, C. (1998). The concept and foundations of infant intersubjectivity. In S. Braten (ed.), *Intersubjective communication and emotion in early ontogeny. Studies in emotion and social interaction* (2nd series, pp.15–46). New York: Cambridge University Press

Tronick, & Z. (1995). Touch in mother-infant interactions. In T.M. Field (ed.), *Touch in early development* (pp.53-65). Hillsdale, NJ: Erlbaum:

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Weinberg, M. K., & Tronick, & Z. (1994). Beyond the face—An empirical-study of infant affective configurations of facial, vocal, gestural, and regulatory behaviors. *Child Development*, 65, 1503–1515.

Weinberg, M. K., & Tronick, & Z. (1996). Infant affective reactions to the resumption of maternal interaction after the still-face. *Child Development*, 67, 905–914.

Weiss, S.J., Wilson, P., Hertenstein, M., & Campos, R. (2000). The tactile context of a mother's caregiving: Implications for attachment of low birth weight infants. *Infant Behavior and Development*, 23, 91-111.

Xua L.S., Qing G. R., Ye M. Y. , et al. (2004). Study of touch intervention of infant sleep disorder. *Journal of Nursing Continual education*, 19(11), 973–976.

Study 3- The effect of infant massage on 2-month-old infants' response to the Still-Face

Abstract

Background: Early social cognition develops from the infant's perception of connections between his/her own actions and the caregiver's social responses; this perception of social contingencies helps the infant to shape a sense of being agent in social exchanges and develop expectations of others' behavior. This process starts from early face-to-face communicative exchanges between infant and mother and develops according to the quality of interaction. Infant massage has been demonstrated to be a modality to enhance mother-infant interaction and related emotional regulation processes.

Aims: The main aim of this study was to investigate whether the practice of infant massage encourages infants to develop early social expectations for their mother's behavior during interaction and capacity for coping with- and recovering from- a stressful interaction.

Method: Forty-seven mothers and their full-term infants, 22 females and 25 males, participated in the research. Twenty-five mother-infant dyads were assigned to a Target Group, who received 5 weeks of infant massage training from the end of the first to the end of the second month of the infant's life, and 22 to a Control Group. Dyads in both groups were videotaped during the still-face (SF) procedure when the infants were 2 months old.

Results: Infants in both groups reacted in similar way during the SF phase, reducing positive engagement and increasing active monitoring and negative affect. However, only infants in the Target Group showed a significant increase in Social Monitoring and in Social Positive engagement with their mothers during the reunion phase. In addition, in the reunion phase the infants' Negative engagement remained significantly higher than in the play phase in the Control group, but not in the Target.

Conclusions: Infants in both groups showed the SF effect, reacting to their non-attuned mother. However, infants who received infant massage showed a better capacity to resume interaction with their mothers after the stressful situation.

Keywords: infant massage, still-face paradigm, mother-infant interaction

Introduction

Touch is universally recognized as a fundamental component of mother-infant interaction (Feldman, 2011; Stack, 2010). Particularly in the first months of life, touch is an influential communicative channel between infant and caregiver, both for communicating emotional states and founding the attachment relationship (Hertenstein, 2002; Jean & Stack, 2012). As many studies (e.g., Stack & Muir, 1992; Tronick, 1995; Weiss, Wilson, & Campos, 2000) report, different types of touch used by mothers (or other caregivers) can convey different emotions to the infant, transmit a sense of security, reduce stress and promote emotion regulation. Specifically, a study by Stack, LePage, Hains and Muir (1996) underlines different functions of touch in mother-infant communicative exchanges and their relationships with emotional states: for example, an active touch can induce positive emotions, while a nurturing touch can induce a relaxed state. Tactile interaction affects mother-infant co-regulation, along with other types of nonverbal communication such as vocal and facial expressions, and gestures.

A number of different techniques such as infant massage use maternal touch in order to enhance mother-infant interaction, also providing several other physiological benefits. Infant massage is a traditional everyday routine in many parts of the world such as Africa, the South Pacific and Asia (Field, Schanberg, Davalos, & Malphurs, 1996) and is normally handed down from one generation to another. For example, 96% of parents in Bangladesh practice infant massage on their infants between one and three times a day (Darmstadt, Samir & Saha, 2002). Even if there is a wide variety of different types of infant massage practiced all over the world, the best known in western culture was introduced by IAIM (1983), the International Association of Infant Massage, founded by Vimala McClure in the USA in the 1980s. The IAIM program includes different types of tactile and kinesthetic stimulation on different parts of the infant's body, providing a combination of Indian and Swedish yoga techniques.

Infant massage has become of scientific interest since the mid-1980s, when Tiffany Field published her first works on the effects of tactile stimulation on preterm infants. During these years, it has been demonstrated that infant massage has several benefits on infant physiology regulation and mother-infant interaction. A number of studies have underlined that infant massage is a powerful way to regulate circadian rhythms

(Goldstein Ferber, Laudon, Kuint, Weller, & Zisapel, 2002), promoting the quality of sleep in infants born at term (Scafidi et al., 1990; Xua et al., 2004); it promotes early growth and development in preterm infants, enhancing their weight and length, and faster discharge from hospital (Field et al., 2004).

Infant massage has been demonstrated to be a modality to improve mother-infant interaction, especially in the case of prematurity, postpartum depression (O'Higgins et al., 2008). An interesting study carried out by Gurol & Polat (2012) highlighted that infant massage could be a modality to promote secure mother-infant attachment. In this study, 117 healthy primiparae mothers with healthy full-term infants – 57 in a target group and 60 in a control group – completed the Maternal Attachment Inventory (MAI) before starting an infant massage experience, which revealed no differences between the groups. Mothers in the target group then received the instruction to massage their healthy infants for 15 minutes for 38 days (min. 30, max. 38). After this period, the mothers in both groups completed the Adult Attachment Inventory once again, revealing that the mean values of MAI in the target group were significantly higher in mothers who had experimented with infant massage in their routine.

Indeed, infant massage is a practice that supports the mother-infant relationship through different elements including tactile and kinesthetic stimulation, social smiling and eye-contact (Purpura et al, 2016), guiding mothers to be responsive and attuned to their infant's cues and signals by adapting their behavior and touch.

Maternal sensitivity, which is the capacity to detect and respond to infant cues in a responsive and accurate manner (Ainsworth, Blehar, Waters & Wall, 1978; Pianta, Sroufe, & Egeland, 1989), is a fundamental maternal characteristic whose role is to support an infant's emotion regulation capacities (Crockenberg & Leerkes, 2000; de Wolff & van Ijzendoorn, 1997). It is in the context of mother-infant interaction that an infant develops different regulatory processes, such as the modulation of emotional expression (Calkins & Hill, 2007; Cohn & Tronick, 1989). Furthermore, it is well known that an infant's early self and other knowledge develops from the infant's perception of connections between her/his own actions and the caregiver's social responses. The perception of social contingencies helps infants to shape a sense of being agent in their social exchanges and develop expectations of others' behavior. This process starts from the first month of life and becomes more complex as the infant grows up. As documented by Lavelli and Fogel (2002, 2013), infants are engaged in

face-to-face communication with their mother from the first weeks of life, at first through listening to her affectionate voice and simple gazing at her face in a process of mutual attentiveness. Toward the end of the second month, the acquisition of exogenous control (Emde & Buchsman, 1989)) and the appearance of social smiling (Spitz, 1965) and prespeech movements and cooing (Trevvarthen, 1979), along with increased visual attention and time spent in an active alert state, bring a qualitative change in mother-infant communication. In this new phase of mutual engagement, infants start to answer the mother with clear signs of social responses which act as positive feedback for mothers, and give rise to sequences of co-regulated exchanges of emotion and attention. Through such co-regulated encounters (Beebe & Lachman, 2002; Fogel, 1993), each mother-infant dyad creates its own communicative patterns, that organize the infant's behavior (Tronick & Beeghly, 2011) by allowing the infant to develop expectations for the other's behavior.

An important aim of early mother–infant face-to-face interaction is to establish a state of reciprocity, considered an important basis for the development of self-regulation. Accordingly, the Mutual Regulation Model (MRM, Gianino & Tronick, 1988; Fogel, 1993; Sander, 2000) explains that mother-infant interaction is a bidirectional exchange of communicative signals used by both mother and infant to maintain interaction and cope with the stress of interactive miscoordinations. It is extremely important that mother and infant are able to cope with stress by communicating emotions, regulating emotional states and responding to their partner in an attuned modality.

The communication of affective signals to the mother, even in a period of perturbation, followed by a sensitive answer from the caregiver establish the basis for the development of the self-regulatory skills needed to cope with longer periods of interactive perturbations such as in the still-face paradigm (Gianino & Tronick, 1988; Tronick, 2007), a measure of maternal attunement and infant self-regulation in the presence of violation of the infant's social expectations (Conradt & Ablow, 2010; Lowe et al., 2012; Mesman et al., 2009; Tronick, 1989; Weinberg & Tronick, 1996).

The still-face paradigm is a sequence of three episodes. In the first episode (Play), mother and infant are involved in normal face-to-face interaction; in the second episode (Still-Face), the mother assumes the typical “still-face” expression, by looking at infant with an inexpressive face and avoiding responding to the infant's signals. Finally, in the last episode (Reunion) the mother resumes interaction with her infant. The violation of

the “rules” of face-to-face communication, because of the contradictory information given to the infant (maternal unresponsive gazing) causes the typical “still-face effect” in infants with a decrease in positive affect and increased negative affect (Mesman, van IJzendoorn, & Bakersmans-Kranenburg, 2009) and a carryover effect in the reunion phase. The responses in the reunion phase are called the “reparatory process”: successful reparation is a sign of dyadic synchrony and attunement in mother-infant interaction (Beeghly & Tronick, 2011; Rosenblum et al., 2002; Tronick & Beeghly, 2011), predicting the future quality of the relationship and development.

It's well documented that infants start to show the still-face effect from the age of 2 months, expressed across a decreasing in gaze and positive affect from the baseline to the still phase and an increase in negative affect and a partial recovery during the reunion phase (Adamson & Frick, 2003; Tronick et al, 1978)

Only one study investigated the role of maternal contact – in the form of maternal skin-to-skin contact– on infant reaction during the still-face paradigm was carried out by Bigelow and colleagues (2010). In this research, the impact of maternal skin-to-skin contact on an infant's social expectations for his or her mother's behavior was studied in a longitudinal design for the first three months of the infant's life. Specifically, 80 mother-infant dyads (28 in the target group, in which infants received 4000 min of skin-to-skin contact during the first week of life, 52 in the control group) participated in the still-face task when the infants were 1 week, 1 month, 2 months and 3 months old. The results underlined that infants in the target group started to be aware of the change in their mother's behavior at 1 month, showing non-distress vocalization. While the differences in the two groups were not significant at two months of age, at three months only infants in the control group decreased their vocalization, while infants in the target group increased this behavior. The results suggest that maternal body contact may increase the self-awareness of infants and social expectations of maternal interactive behavior.

The main aim of this study was to investigate whether the practice of infant massage encourages infants to develop early social expectations for their mother's behavior during mother-infant communication, and capacity for coping with- and recovering from- a stressful interaction. Specifically, we investigated whether 2-month-old infants who had the daily experience of close interaction with their mother through the practice of infant massage (Target group), compared to peers in a Control group, show different

reactions to the perturbation of mother-infant interaction during the Still-Face procedure and/or different behaviors in the reunion phase.

It is well known that at around 2 months of age infants start to demonstrate the so called “still-face effect”. Therefore, we did not expect infants in the Target group to show significantly different behaviors compared to those expressed by their peers in the Control group in the different phases of the SF procedure but, rather, subtle differences in intensity of behaviors and higher proportions of social positive engagement (though with expected significant decrease in the SF phase) during the whole procedure. In particular, we expected:

1. a stronger “still-face effect” in infants in the Target Group, especially in terms of attempts to resume the mother's responsiveness, due to the experience of attuned mother-infant interaction developed through infant massage;
2. a weaker “carryover effect”, that is, a good recover of social positive engagement in the reunion phase in infants in the Target group, due to capability of emotion regulation developed through the infant massage experience.

2. Method

Participants

Participants were 42 mothers and their full-term infants, 25 males and 22 females, recruited at the “Policlinico G.B. Rossi” Hospital in Verona and the “Sacro Cuore” Hospital in Negrar (Verona) during the first 3 days after the deliver. About 300 mothers were informed about the study; 80 mothers consented to be contacted at the third week of infant's life and 47 of them accepted to participate in this study.

Mothers recruited in the first Hospital ($N=25$) were contacted to take part to a study on infant massage (Target Group); mothers recruited in the second Hospital ($N=22$) were contacted to be involved in a study in the development of mother-infant interaction (Control Group).

Mother-neonate dyads were selected on the basis of (a) absence of obstetrical and neurological complications (no particular medication during pregnancy and delivery; full term delivery, normal birth weight, above 2,500 g), (b) absence of medical indications or physical or psychological disease on the part of the mothers, (c) the

mother's age being above 20 and under 40 years and both the mother and father being Italian. In the Target Group, gestational age was 39.2 weeks ($SD=0.79$), weight at birth 3.450 ($SD=0.21$); 23 infants were born with natural delivery, 2 with caesarian; maternal age was 31.34 ($SD=2.54$) and the years of education were 16.00 ($SD=4.21$); 22 out of 25 infants were initially breast fed. In the Control group, gestational age was 39.21 ($SD= 0.87$), weight at birth 3.210 ($SD=0.78$). Maternal age was 33 ($SD=4.52$), and the years of education were 15.67 ($SD= 3.32$). Nineteen out of 22 infants were initially breast-fed.

Procedure

Mothers who agreed to be called back during recruitment at the hospitals were contacted by the researcher when the infants were about three weeks old.

Those who accepted to take part in the research were included in a larger project and every dyad allocated to the Target Group received 5 weeks of infant massage training at home, starting the following week. We chose the one-to-one modality instead of group training to accommodate every mother's needs and ensure that mothers could attend every lesson. Among other visits, dyads in both groups received a visit from the researcher at home when infants were 2 months old. During this appointment, in the natural context of their house, dyads were involved in the still-face paradigm. For the modality, see the *Videotaping* section.

Type of intervention

A certified IAIM instructor provided a 5-week infant massage training course for every dyad in the Target Group between the first and second month of the infant's life.

The IAIM program, developed by Vimala McClure (1983), is a set of different techniques, including Indian and Swedish yoga and McClure's self-developed techniques. The massage includes different types of tactile stimulation, such as caresses, squeezing of arms and legs, gentle pressure and some kinesthetic stimulation such as flexion and extension of arms and legs. Every week, mothers learned how to massage different zones of their infant's body: feet and legs in the first week; tummy and chest in the second; arms and face in the third; back in the fourth; while the last week was dedicated to teaching some playful and yoga movements to mobilize the infant's legs and arms. Mothers were asked to massage their infant once a day if possible and no less than 4-5 days a week if this was not feasible.

The fundamental indication to start massage was the active or quiet alert state of the infant; mothers were instructed to read infant signals of availability such as bright eyes, quiet alert state, eye contact, and signs of unavailability such as pre-sleeping state and fussy or clumsy movements. The length of every massage session was determined by the infant's availability to receive tactile stimulation.

Videotaping

Infants were seated on an infant seat placed on a table approximately 50 cm high, facing their mothers at eye-level roughly 40 cm away.

A mirror was placed behind the infant to reflect the mother's face; two video cameras were positioned 2 meters away; the one on the right recorded the infant's face and body, the mother's hands and the mother's face reflected in the mirror, while the one on the left recorded the whole situation.

The still-face procedure consists of a sequence of three episodes. Firstly, there were 2 minutes of free play interaction, in which mothers were instructed to behave as they normally would during interaction with their infants. Secondly there was a still-face episode, in which mothers were asked to interrupt any form of communication with their infants, but still look at their face with a neutral expression for 1 minute and 30 seconds. Finally, there was a 2-minute reunion, in which mothers were asked to resume normal interaction with their infants.

Coding

Infants' and mothers' behaviors were coded using a modified version of “infant and caregiver engagement phases,” (ICeP; Weinberg & Tronick, 1998; see also Tronick et al., 2005). The modified ICeP system consists of a set of mutually exclusive infant and caregiver phases of interactive engagement (negative engagement, withdrawn, non-infant focus engagement, social monitor, social positive monitor for maternal behaviors, negative engagement, withdrawn, object/ environment engagement, social monitoring, active social monitoring, positive engagement for infant behaviors) and a set of co-occurrent regulatory infant behaviors (mouthing, self-clasping, distancing from mother).

We coded each episode second-by-second.

7 dyads were excluded from coding, in cases 2 because of the infant's unavailability to take part in the paradigm and in 5 cases for procedural and/or recording errors.

Table 1. *Infant engagement*

Negative engagement	The infant is negative or protesting. The infant displays negative facial expression (&.g. sadness, distress, crying, or grimacing), complaining, being fussy, crying vocalizations. When the infant is protesting, he/she often displays facial expression of anger, grimaces and is fussy/crying.
Withdrawn	The infant is withdrawn and minimally engaged with the caregiver. This phase often includes sad facial expressions, whimpering vocalizations, slumped posture and gaze aversion.
Object/ environment engagement	The infant looks at objects that are either proximal (e.g., infant seat) or distal (&.g. camera). The infant may manipulate proximal objects (e.g., infant chair strap; caregiver's hands).
Social Monitoring	Gazing at caregiver's face/eyes with a neutral or interested facial expression. The infant may vocalize in a neutral manner.
Active Social Monitoring	Gazing at caregiver face/eyes with high arousal and sustained concentrated visual attention, motor activity including limb movements and gestures towards the mother. The infant may vocalize in order to attract the mother's attention
Social Positive engagement	Gazing at caregiver's face/eyes while smiling. The infant may vocalize in a positive manner.

Table 2. *Infant self-regulation*

Mouthing	The infant sucks on his/her body (e.g., thumb or wrist)
Self-Clasping	The infant's two hands are touching

Distancing	The infant's shoulders and trunk are rotated sideways from the caregiver and the infant's head is averted
-------------------	---

Table 3. *Maternal behaviors*

Negative	The adult is negative, intrusive or hostile
Withdrawn	The adult is minimally engaged and withdrawn with the infant (disengagement from infant for gaze direction, facial expressions and/or vocalizing)
Non-infant engaged	The adult does not attend to the infant and is involved in a non-infant focused activity
Social Monitoring	Gazing at infant with neutral/interested expression or with positive vocalizing.
Social Positive Monitoring	Positive affect (smiles, laughter, exaggerated expressions)

Reliability

Videotaping of mother-infant interaction was coded by 4 coders blind to the aims of the research. Inter-rater reliability was calculated using 20 videos (25% of videotapes).

It was considered in agreement if the independent coders entered the same code with a 1s difference, otherwise it was considered in disagreement.

For infant behaviors the Cohen's Kappa average was .80.

For maternal behaviors the Cohen's Kappa average was .83.

Statistical analysis

First, we transformed all data in Z-scores. Then, in order to check if behavioral data were normally distributed, we applied the Shapiro–Wilk test. Not all p -values were greater than the chosen alpha level (0.05). We utilized Kruskal-Wallis for non-parametric data and the difference was statistically significant, $\chi^2 = 131.932$, $df = 35$, $p < .05$. Subsequently, we conducted pairwise Wilcoxon-Mann-Whitney corrected test used as post hoc test for every category.

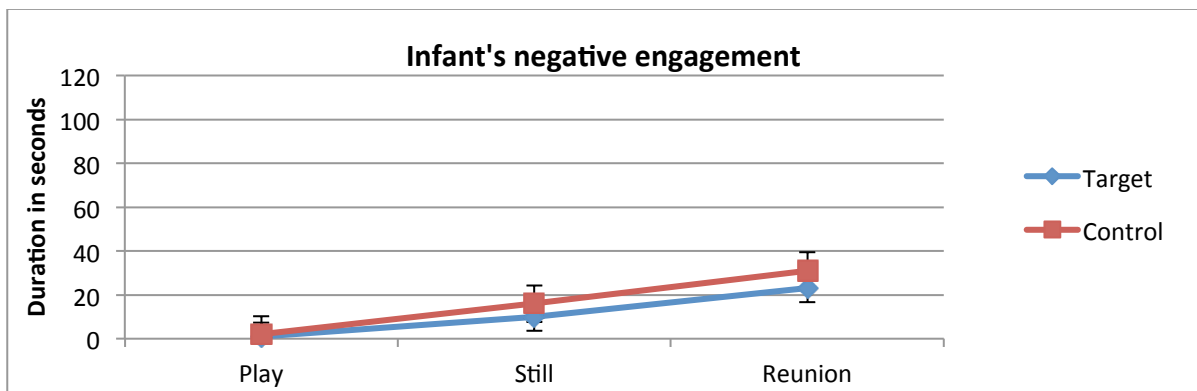
3. Results

Infant engagement

Negative engagement

For negative engagement, we didn't find any significant differences during the three phases of the procedure in the Target Group. In Control Group we found a significant increasing between P1 and P2 ($p = .01$); furthermore, negative engagement was significantly higher in P3 than in P1 ($p = .01$).

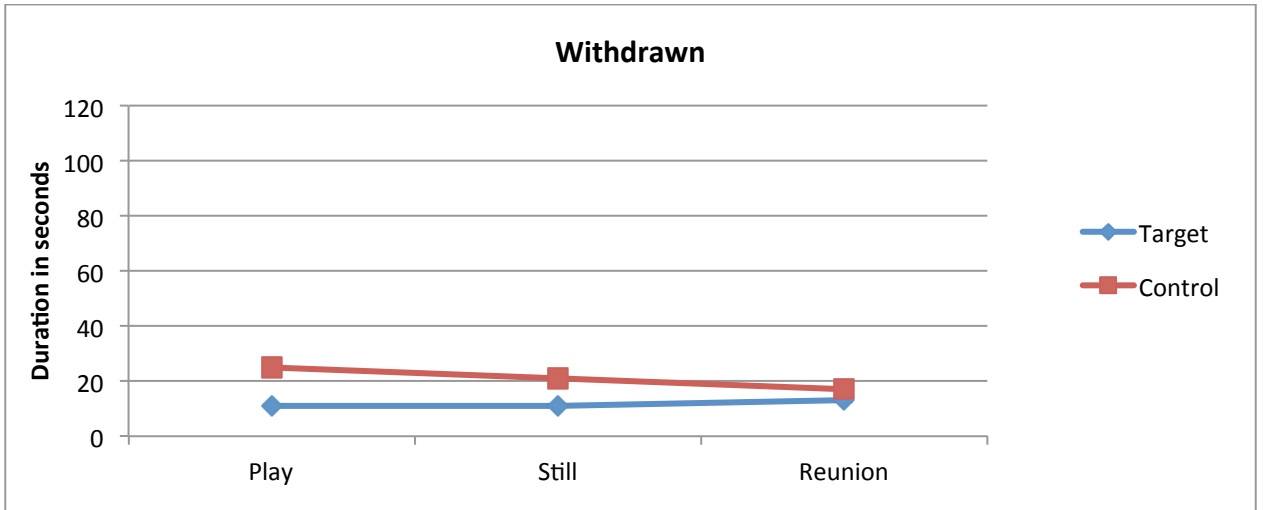
Fig1. Infant Negative engagement



Withdrawn

For withdrawn behavior, analysis didn't show any differences across time and between groups.

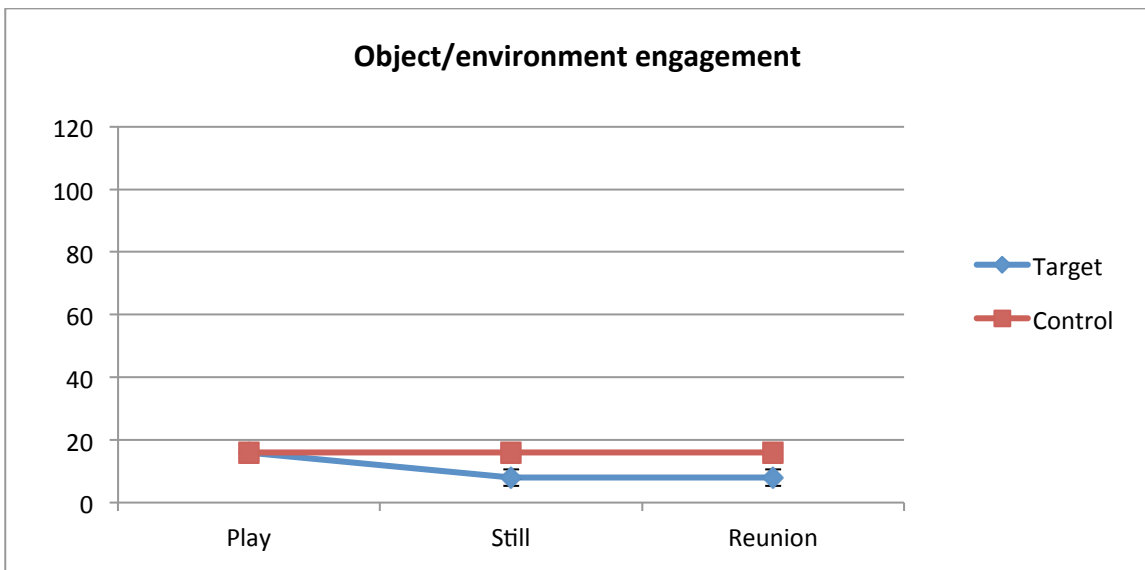
Fig.2 Withdrawn



Object-environment engagement

For object-environment engagement, analysis didn't show any differences across time and between groups.

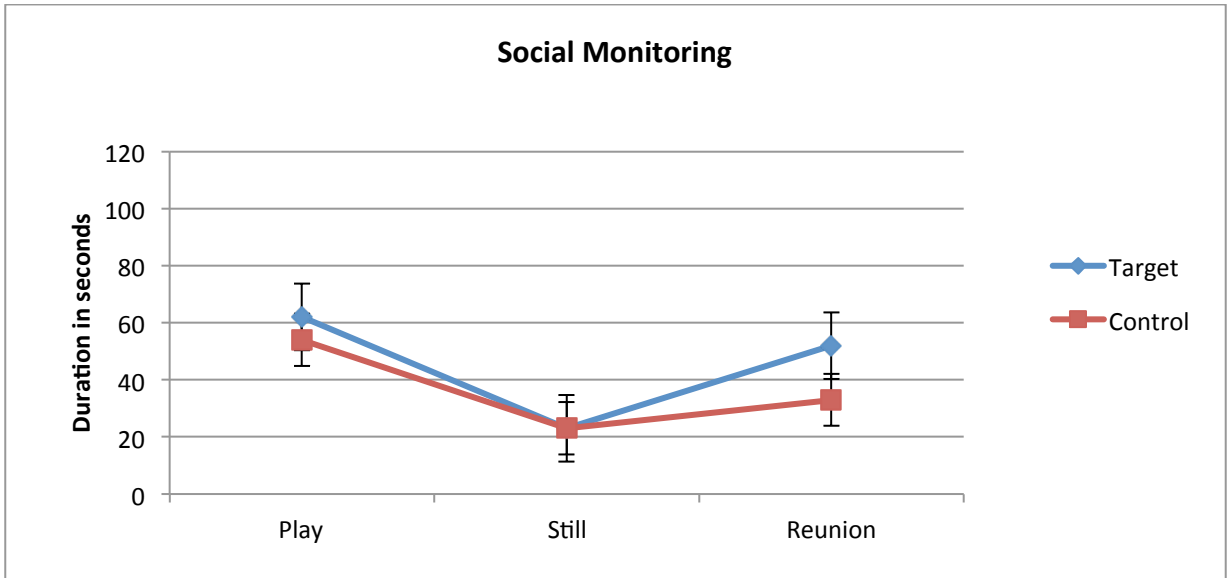
Fig.3 Object/environment engagement



Social monitoring

For social monitoring, we found a significant decreasing in both groups between P1 and P2 (Target Group, $p < .001$; Control Group, $p = 0.02$) and a significant increasing between P2 and P3 only in Target Group ($p = .02$).

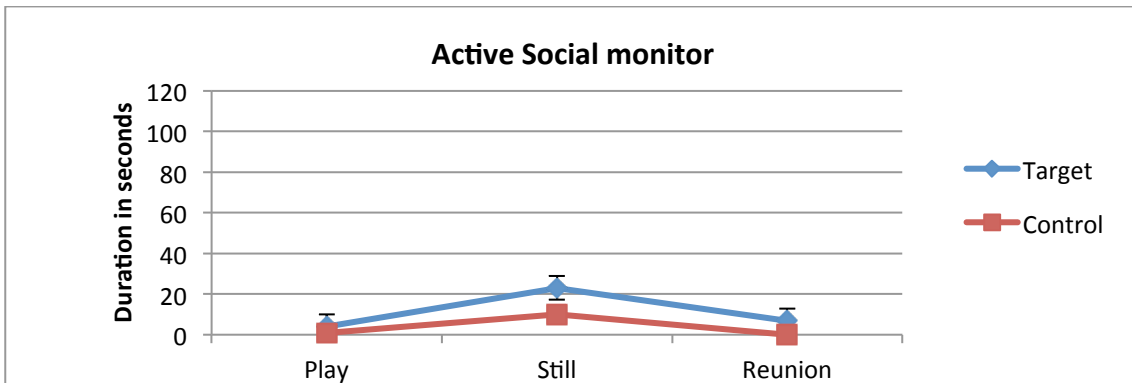
Fig4. Social monitoring



Active social monitoring

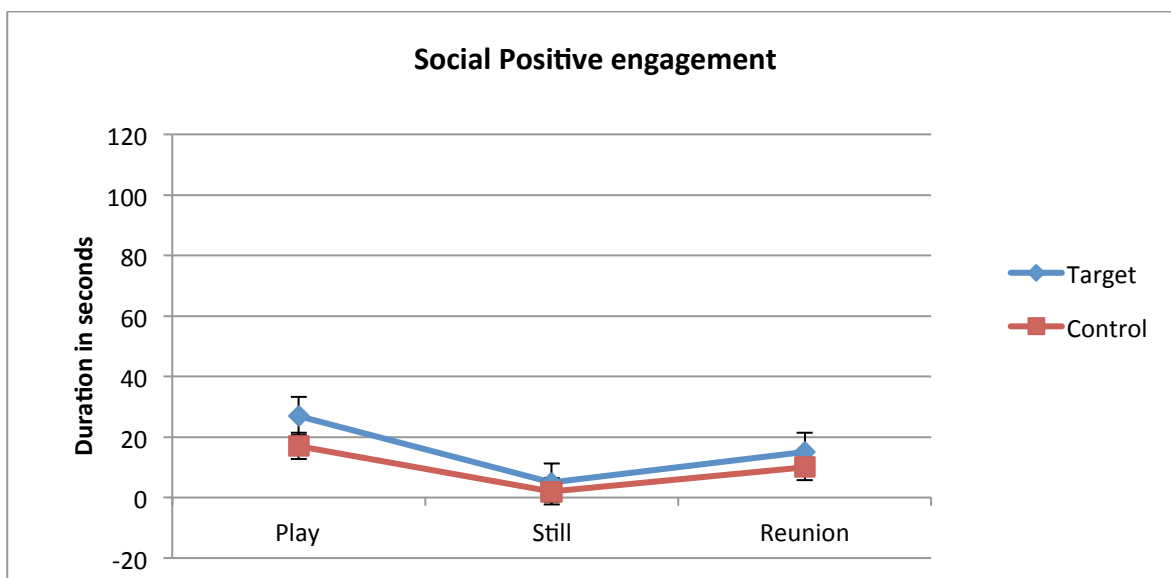
For active social monitoring, analysis showed a significant increasing in both groups between P1 and P2 (Target Group, $p < 0.01$, Control Group, $p = .02$).

Fig.5 Active Social Monitor



Social positive engagement

Social positive engagement analysis showed a significant decreasing in both groups between P1 and P2 (Target Group, $p < .01$, Control Group, $p < .01$).



Infant self-regulation

For infant self-regulation, we didn't find any difference.

Maternal engagement

For maternal engagement, we didn't find any difference

4. Discussion

The main objective of this study was to investigate the reaction to the violation of maternal communication in 2 month-old infants who received infant massage almost daily for one month, analyzed through the Still-face paradigm. This procedure evaluates dyadic interactive characteristics and emotional regulatory strategies in a stressful situation. Specifically, the still-face consists of three different segments: an initial face-to-face interaction episode, a central still-face episode in which the mother has to interrupt any communication with her infant while holding a neutral expression and a third phase, called the reunion phase, in which the caregiver resumes normal face-to-face interaction with the infant.

Normally, infants start to show the still-face effect from the age of 2 months: literature reports that the main effects of the violation of maternal contingency are, from the baseline to the still phase, a decrease in gaze and positive affect and an increase in negative affect and a partial recovery during the reunion phase (Adamson & Frick, 2003; Tronick et al, 1978). Furthermore, it has been observed that infants increase motor activity during the still-face phase (Jamieson, 2004; Lamb, Morrison, & Malkin,

1987; Stoller & Field, 1982), as well as tactile object- and self-stimulation (Moszkowski & Stack, 2007; Rosenblum, McDonough, Muzik, Miller & Sameroff, 2002; Tronick et al., 2005).

Our main hypothesis was that infants in the Target Group would have different reactions compared to a Control Group in the still-face phase and the reunion phase.

Both groups behaved in the same way during the still-face phase, showing the typical “still-face effect”: we observed a significant increase in positive affect and monitoring behavior; we only found a significant increase in both groups for active social monitoring, described as the infant's sustained arousal, increasing motor activity and vocalization in order to get the mother's attention, with a higher mean in the Target Group. However, the results did not show any statistical differences. Interestingly, we found an increasing in negative affect in both groups, significantly only in the Control Group.

This result underlines infants' capacity to regulate their own emotions during stressful situations such as maternal emotional unavailability, starting from a very early stage of life.

We also found some significant differences in how infants reacted during the reunion phase in the two groups; the results confirmed our second initial hypothesis. Normally, during the reunion phase, infants are likely to exhibit a carryover of negative affect and a rebound of positive affect, while mothers attempt to remedy the stressful situation (Mesman et al., 2009; Weinberg et al., 2008; Tronick and Beeghly, 2011).

Our results indicated a carryover effect of negative engagement in both groups, but with significant differences regarding monitoring behavior (social monitor): it showed a significant increase after the still-face phase only in the Target Group.

This may underline that infants who experienced infant massage have a better capacity to regulate their emotions and resume more coordinated interaction with their mother after a stressful situation, returning to look at their mother's face. Kogan and Carter (1996) found that 4 month-old infants who displayed more negative affect during the reunion phase were less likely to show contact maintenance, an index of secure attachment, during the strange situation at 1 year. Furthermore, the reunion episode is extremely important in revealing the adaptive mechanism of infants to use the caregiver as support after the disruption of the dyadic regulation system (Kogan & Carter, 1996). The authors underline that maternal sensitivity is a predictor of better re-engagement in

this phase and infants who can recover successfully in the reunion episode have mothers that show responsive and sensitive behaviors during interaction (Conradt & Ablow, 2010; Haley & Stansbury, 2003; Mesman et al., 2013; Rosenblum, McDonough, Muzik, Miller, & Sameroff, 2002). Furthermore, the development of maternal attuned responses to the infant's behavior is the main goal of the infant massage experience. The development of adaptive emotion regulation processes, such as the capacity to modulate, inhibit and enhance emotional experiences and expressions (Calkins & Hill, 2007), develops in the context of mother-infant interaction (Calkins & Hill, 2007; Cohn & Tronick, 1989) in mutually regulated interaction. There are some factors that contribute to the success or failure of mutual regulation, such as infants' capacity to control their behaviors and physiological states, the maturation and integrity of different elements of infant communicative systems such as attention, motor skills, affective displays and the mother's ability to interpret infant communication signals, in addition to the mother's capacity to be attuned and enhance the infant's regulatory attempts.

When the infant can initiate reparation by showing affective signals and when the partner is responsive and sensitive to these signals, the infant starts to develop self-regulatory skills that are fundamental to cope with longer periods of mismatching during communication. Brief dyadic mismatches are frequent in mother-infant interaction, but when they are quickly repaired, they support the infant's mental representation of self-efficacy.

Furthermore, we know that maternal touch plays a fundamental role in infant emotion regulation: a study carried out by Ferber and Makhoul (2004) underlined that infants who received an amount of maternal touch through skin-to-skin contact immediately after birth showed better regulatory capacities.

Infant massage could be a modality to develop more attuned mother-infant interaction after a stressful situation thanks to its touch regulatory capacities . It is extremely important to consider that positive affect is the most common type of affect in attuned dyads, a characteristic that is maintained through reparation in everyday routine (Mayes & Carter, 1990; Tronick & Cohn, 1989).

References

- Adamson, L. B., & Frick, J. &. (2003). The still face: A history of a shared experimental paradigm. *Infancy*, 4(4), 451–473
- Ainsworth, M.D., Blehar, M. C., Waters, &., & Wall, S. (1978). Patterns of attachment: A psychological study of the strange situation. *Hillsdale, NJ: Lawrence Erlbaum*
- Beeghly, M., & Tronick, &. (2011). Early resilience in the context of parent–infant relationships: A social developmental perspective. *Current Problems in Pediatric and Adolescent Health Care*, 4, (7), 197–201
- Bigelow, A. &., Power, M. (2012) “The effect of mother-infant skin-to-skin contact on infants' response to the Still Face Task from newborn to three months of age”. *Infant Behavior and Development*, 35, 240-251.
- Calkins, S. D., & Hill, A. (2007). Caregiver influences on emerging emotion regulation: Biological and environmental transactions in early development. In J. J. Gross (ed.), *Handbook of emotion regulation (pp. 229–248)*. New York: The Guilford Press
- Cohn, J. F., & Tronick, &. (1989). Specificity of infants' response to mothers' affective behavior. *Journal of the American Academy of Child and Adolescent Psychiatry*, 28, 242–248
- Crockenberg, S., & Leerkes, &. (2000). Infant social and emotional development in family context. In C. H. Zenah (ed.), *Handbook of infant mental health (pp. 60–90)*. New York: The Guilford Press.
- Darmstadt, G., Samir, K., & Saha. (2002). Traditional practice of oil massage of neonates in Bangladesh. *Journal of Health, Population and Nutrition*, 20 (2), 84-88.
- de Wolff, M. S., & van Ijzendoorn, M. S. (1997). Sensitivity and attachment: A meta-analysis on parental antecedents of infant attachment. *Child Development*, 68, 571–591.
- Emde, R. N., & Buchsbaum, H. K. (1989). Toward a psychoanalytic theory of affect: II. emotional development and signaling in infancy. In S. I. Greenspan & G. H. Pollock (eds.), *The course of life (2nd ed., pp.193–227)*. Madison, CT: International Universities Press.

Emde, R. N., Gaensbauer, T. J., & Harmon, R. J. (1976). Emotional expression in infancy: A biobehavioral study. *Psychological Issues (Monograph 37)*. New York: International Universities Press.

Feldman, R. (2011). Maternal touch and the developing infant. In M. J. Hertenstein, & S. J. Weiss (eds.), *The handbook of touch: Neuroscience, behavior, and health perspective* (pp. 373–407). NY: Springer Publishing Company.

Ferber SG, Laudon M, Kuint J, Weller A, Zisapel N.(2002) Massage therapy by mothers enhances the adjustment of circadian rhythms to the nocturnal period in full-term infants. *Developmental and Behavioral Pediatrics*; 23 (6), 410–5.

Field, T., Schanberg, S., Davalos, M., & Malphurs, J. (1996). “Massage with oil has more positive effect on normal infants”. *Journal of Prenatal and Perinatal Psychology and Health*, 11 (2), 75-80.

Field, T., Hernandez-Reif, M., Diego, M., Feijo, L., Vera, Y., & Gil, K. (2004). “Massage therapy by parents improves early growth and development”. *Infant Behavior and Development*, 27 (4), 435-442.

Gianino, A., & Tronick, & Z. (1988). The mutual regulation model: The infant’s self and interactive regulation and coping and defensive strategies. In T. Field, P. McCabe, & N. Schneidermann (eds.), *Stress and coping across development* (pp. 47–68). Hillsdale, NJ: Erlbaum

Gratier, M., Devouche, &, Guellai, B., Infanti, R., Yilmaz, &, Parlato, &. (2015). “early development of turn-taking in vocal interaction between mothers and infants”, *Frontiers in Psychology*, 6, 1167.

Gurol, A., Polat, S. (2012) “The effects of Baby Massage on attachment between mother and their infants”. *Asian Nursing Research* 6 (1), 35-41.

Hertenstein,(2002): Touch: Its communicative functions in Infancy. *Human Development*, 45, 70-94

Jamieson, S. (2004). Identifying precursors of attachment in the Still-Face paradigm. Unpublished Doctoral dissertation

Jean, A. D. L., Stack, D.M. (2012). “Full term and very-low-birth-weight preterm infants’ self regulation behaviors during a Still-Face interaction: Influence of maternal touch”. *Infant behavior and Development*, 35, 779-791.

Kogan, N., & Carter, A. S.(1996).Mother–infant reengagement following the still-face: The role of maternal emotional availability in infant affect regulation. *Infant Behavior & Development*, 19, 359–370.

Lamb, M. &, Morrison, D. C., & Malkin, C. M. (1987). The development of infant social expectations in face-to-face interaction – A longitudinal-study. *Merrill-Palmer Quarterly-Journal of Developmental Psychology*, 33, 241–254

Lavelli, M., Fogel, A., (2005). Developmental changes in the relationships between infant's attention and emotion during early face-to-face communication: The 2-month transition. *Developmental Psychology*, 41, 265-280.

Lavelli, M., Fogel, A., (2013). Interdyad differences in early mother-infant face-to-face communications: real time dynamics and developmental pathways. *Developmental Psychology*, 49, 2257-2271

McClure, V. (1998). *Teaching Infant massage: a handbook for instructors*. Denver: International Associations of Infant Massage.

Mesman, J., van Ijzendoorn, M. H., & Bakermans-Kranenburg, M. J. (2009). The many faces of the still-face paradigm: A review and meta-analysis. *Developmental Review*, 29, 120–162.

Moszkowski, R. J., & Stack, D. M. (2007). Infant touching behavior during mother–infant face-to-face interactions. *Infant and Child Development*, 16, 307–319.

O’Higgins, M., St. James Roberts, I., & Glover V. (2008). “Postnatal Depression and mother infant outcomes after infant massage”. *Infant Behavior and Development* 109, (1-2); 189-192.

Onozawa, K., Glover, V., Adams, D., Modi, N., & Kumar R.C. (2001). “Infant massage improves mother–infant interaction for mothers with postnatal depression.” *Journal of Affective Disorders*, 63, 201–207.

Pianta, R. C., Sroufe, L. A., & Egeland, B. (1989). Continuity and discontinuity in maternal sensitivity at 6, 24, and 42 months in a high-risk sample. *Child Development*, *60*, 481–487.

Purpura, G., Tinelli, F., Bargagna, S., Bozza, M., Bastani, L., Cioni, G. (2014). Effect of early multisensory massage intervention on visual functions in infants with down syndrome. *Early Human Development*, *90* (12), 809-813

Rosenblum, K. L., McDonough, S., Muzik, M., Miller, A., & Sameroff, A. (2002). Maternal representations of the infant: Associations with infant response to the still face. *Child Development*: *73* (4), 999–1015.

Scafidi, F.A., Field, T.M., Schanberg, S.M., Bauer, C.R., Tucci, K., Roberts, J., Morrow, C., & Kuhn C. M. (1990). "Massage simulates growth in preterm infants: A replication. *Infant behavior and Development*, *13*, 167-188

Stack, D. M., Muir, D.W. (1992). "Adult tactile stimulation during face-to-face interactions modulates 5-months-olds' affect and attention. *Child Development*, *63*, 1509-1525.

Stack, D.M., & LePage, D.&. (1996). Infants' sensitivity to manipulations of maternal touch during face-to-face interactions. *Social Development*, *5*, 41–55.

Stack, D. M. (2010). Touch and physical contact during infancy: Discovering the richness of the forgotten sense. In J. Gavin Bremner, & T. D. Wachs (Series eds.) &, *Wiley-Blackwell handbook of infancy development : Vol. 1. (2nd ed., Vol. 1, pp. 535–567)*. England: Basic Processes.

Stoller, S., & Field, T. (1982). Alteration of mother and infant behavior and heart rate during a still-face perturbation of face-to-face interaction. In T. Field & A. Fogel (eds.), *Emotion and early interaction (pp. 57–82)*. Lawrence Erlbaum.

Tronick, & Z. (1995). Touch in mother-infant interactions. In T.M. Field (ed.), *Touch in early development (pp.53-65)*. Hillsdale, NJ: Erlbaum.

Tronick, & Z. (1989). Emotions and emotional communication in infants. *American Psychologist*: *44* (2), 112–119.

Tronick, & Z., Messinger, D. S., Weinberg, M. K., Lester, B. A., LaGasse, L., Seifer, R., et al (2005). Cocaine exposure is associated with subtle compromises of infants' and mothers' social-emotional behavior and dyadic features of their interaction in the face-to-face still-face paradigm. *Developmental Psychology, 41*, 711–722.

Tronick, (2007). *Neurobehavioral and social emotional development of infants and children*. New York: Norton.

Tronick, &, & Beeghly, M. (2011). Infants' meaning-making and the development of mental health problems. *American Psychologist: 66* (2), 10

Weiss, S.J., Wilson, P., Hertenstein, M., Campos, R. (2000). The tactile context of a mother's caregiving: Implications for attachment of low birth weight infants. *Infant Behavior and Development, 23*, 91-111.

6. Conclusions

The main aim of the present dissertation was to investigate the role of infant massage on the development of the intersubjectivity in the first three months of infant's life.

The three studies presented above demonstrated that infant massage has an impact on infant's development and mother-infant interaction at different levels.

In this work we could demonstrate that maternal touch, in mothers who experimented infant massage, was more frequent at three months, more playful and affectionate, compared to a control group; our findings suggest that infant massage is an important way to improve maternal touch in mother-infant interaction, both in terms of quantity and of quality. Improving mother-infant communication through touch may have an important positive impact on infant development, mother-infant co-regulation and infant attachment.

Furthermore, we found a significant increasing at 3 months in time spent in interaction with mothers and cooing expression in infants who received infant massage; mothers, on the other side, improved their stimulating behaviors, suggesting a more active interaction in dyads in the Target group.

For what concern infant's early social expectations at two months, studied through the Still-Face Paradigm, infant massage seems to have an impact on infants' behavior during the reunion phase: they demonstrate a significant increasing gazing at mother after a stressful situation, and a less carryover negative affect, compared to infants in Control group.

On the whole, infant massage seems to have a positive impact on mother-infant interaction at different levels and infant's development, with possible important consequences on infant attachment.