

Original Article

The Effect of decreased General irritability on infant's attention

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Abstract

Introduction: The dynamic interaction between mother and infant is one of the indicative factors of infants' social and emotional development especially in stressful situations as cognitive evaluating.

Methods: An experimental study was completed in 2010 in Tehran on a total of 40 infants (18 boys and 22girls) forming two alternative groups and varying in age of infancy (4, 6, 8, 10 and 12 months). We used a 60 second mute popular "Tom & Jerry" animation to compare the infants' attention in the presence or absence of mothers' lap. Changes in orientation time, duration of sustained attention, and the total look duration were measured in terms of eye movement and heart rate changes through pulse oximeter. Furthermore, infants' presence of general irritability in both conditions was observed.

Results: We found that infants in their mothers' laps showed more length of total look duration and sustained attention and less amount of general irritability than those sitting on baby seats. However, we have found no significant differences in infants' total look duration, sustained attention and general irritability across age. Moreover, no significant differences in infants' orientation were found across two groups of infants' positioning.

Conclusion: Mother's presence in the site can be considered as an external force of controlling for kids in doing their tasks thereby increasing their duration of focusing attention on the task.

Declaration of Interest: None.

Keywords: Infant positioning, Sustain attention.

Introduction

The importance of dynamic interaction between mother and infant has been proved to be the indicative factor of infants' social and emotional development and further regulation (1,3). Emotion regulation, as an internal and external regulative processing, emerges in early infancy as the result of mother's pacification. Such regulatory power

monitors, evaluates and modifies infants' later emotional reaction in possible distressed situations (4). The immature ability of self-regulation is challenged when the infant is exposed to distressing situations. It is believed that infants' emotion regulation is the result of infants' selfand other interaction. In a study, Landry, Swank, Baldwin, Denson, and Wildin (1996) found that using attention maintaining strategy (hear, mothers' presence in the room and their manipulation of objects) resulted in more infants' sustained attention and further inhibiting control (5). Elsewhere, Jahromi, Putnam, and Stifter (2004) revealed that holding/rocking with no vocalization, holding/rocking with vocalization,

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And vocalization with no holding/rocking is the most frequent and efficient ways of calming an infant (6). In this respect, researchers (7,10) claimed that maternal soothing would influence infants' reactions in distressful situations.

Furthermore, maternal soothing behavior seems to have a developmental effect on infants, especially in early ages (5,11,12). For example, Findji (1993) and Findji (1998) have emphasized the effectiveness of maternal interference in the development of infants' attention capacity (13,14). The minimum effect of embracing an infant is restraining his physical activities. Although the nature of relationship between two mechanisms of attention and movement is far from clear, what seems to be probable is that infants' sustained visual attention on a task is in contrast with their hyperactivity. If this is true, parents may increase their infants' attention through imposing limitation on their physical activity through maternal soothing behavior. For instance, Lawson, Parrinello and Ruff (1992) investigated the association between maternal behavior and 12-month-old infants' attention to objects during a period of joint play found out that the infants, when physically limited by their mothers, showed more attention to toys and thereby lowering their inattention (15). Elsewhere, Bigelow found that mother and infant skin-to-skin contact has a significant effect on infants' success in accomplishing a cognitive and comprehension task (1).

In line with the above-mentioned issues, this study attempts to investigate attentional ability of forty infants, ranging from 4 to 12 months, across two different positioning situations in a laboratory.

Our first goal was to compare the effect of two infants' positioning on their attention ability. We hypothesized that mothers' presence while embracing the child in their arms can be lowering infants' stress and irritability and thereby increasing infants' attention

ability. Our second goal was to investigate the effect of age on infants' discomfort reactivity (irritability), duration of sustained attention, total look duration and orientation in two different types of infant positioning. Two positioning situations used in this study were infant's positioning on a baby seat and infant's sitting on mother's lap without verbal communication.

Methods

This study was experimental and conducted on a total number of 40 infants varying in age between 4 and 12 months. The participants were assessed in Saghi non-governmental medical center for children vaccination. The infants were selected based on availability after gaining their parents' consent on participating in this research. The inclusion criteria were: (1) infants without any specific disease or anomalies, (2) those with no consumption of medicines since birth, (3) and those who were born healthy following a full-term pregnancy with having the minimum weight of 2500 gram at birth. The exclusion criteria were drowsiness, being lethargic, having too much irritability, and muteness.

The participants were divided into two groups of 20 subjects. Each infant underwent a medical examination by a pediatrician to confirm his/her health. To observe the ethical issues, parents were informed about the detailed information of the study and signed a written consent form to include their babies in this study. Demographic information was collected electronically, and all traveling expenses were reimbursed.

The research was done in 4m² (2m × 2m) square insulated room. The location was darkened completely during the experiment by turning off all lights gradually. Moreover, the room had no windows to the outside. To ensure lack of light reflection, all walls were covered with black material.

Another instrument used in this research was a 27-inch color TV. The infants in the first group were sitting on their mothers' lap perpendicular to and distanced approximately 60 cm from the TV. Moreover, three Panasonic cameras with shooting capability in dark area were used, two of which were placed in the middle and above the monitor, and the last one was placed in front of pulse oximeter to record heart rate changes. These cameras were connected to the examiner's computer. The examiner controlled the stimulus playback through a wireless system.

Another instrument used in this study was the special software to record infants' eye movements and heart rate changes. The program was written in Microsoft visual C ++ and Microsoft direct X SDK 9.0. It has the ability to simultaneously record infants' eye movements and heart rate (HR) changes every second. The data were evaluated both online and offline. Finally, the stimulus used in this study was the popular and famous animation of "Tom & Jerry" which was mutely displayed for 60 seconds.

Four dependent variables were used in this study. The first variable is orientation time, an interval variable, which refers to the time when infants' heart rate (HR) decreases after the initiation of the first look. This variable is measured through estimating the length of time of infants' orientation in seconds. The next variable is duration of sustained attention, an interval variable measured in seconds, which refers to brain activation and is an indicative factor of system alertness when conscious and controlled cognitive processing of information start. A five-point decreasing pulse of HR identifies duration of sustained attention after the orientation phase. These two variables were assessed based on both HR changes and eye movement patterns. The third variable is the total

look duration, an interval variable measured in second, which refers to the total look that an infant takes on a stimulus. Total look duration was measured through infant's eye movements.

The fourth variable is infant's general irritability, which refers to his frustration and agitation, which is assessed using infant's facial expressions. General irritability is determined in a categorical form with 1 indicating as irritability and 2 indicating as child calmness and even-temperedness. Irritability refers to the infants' gestural expressions like frowning, restlessness, and oversensitivity after which the infants start crying.

The independent variables are two different infants positioning: one is sitting on mother's lap without any verbal communication and the other is infant's sitting on baby seat. In the former case, mothers held their babies and circled their hands around their bodies. Moreover, age is studied as the possible dependent variable with five levels of 4, 6, 8, 10, and 12. These five levels covered infants' different levels of cognitive development, which starts at 3 months old, and continue to 12 months old.

To conduct this study, the following steps were taken. First, preparing infants before the onset of the test was very important to reduce their stress and thereby providing a suitable condition for the research. To do this, infants, initially, were played with some toys for 5-10 minutes while the researcher was communicating with the infant. Meanwhile, the researcher's assistant and his mother installed the specific infant's sensor of the pulseoximeter to the infant's right leg big toe and dimmed off light gradually.

While the light was reducing gradually, researcher and assistant after installing the sensors continues to play with toys and infants. At this point mother went to back of his seats and stood with a little distance. A simple black and white stimulus was displayed to attract infant's attention while the

researcher and the assistant went out of the room. After the test room totally darkened, the main stimulus was displayed. To record the baseline data, HR changes were recorded seven seconds before the stimulus onset.

As was stated earlier, the stimulus used in this study was the popular and famous animation of "Tom & Jerry" which was displayed for 60 seconds. As the posttest, after displaying the stimulus, eye movements and heart rate changes were recorded for 7 seconds.

Sustained attention and orientation measurement due to the limitations of the study, no computer-joined pulseoximeter was used to save data automatically. Instead, the current software was expanded in a way to record both HR and eye movement data simultaneously and without delay. This way, the baseline data (pretest), during exposing to stimulus data, and post-test (when stimuli were removed) data were recorded on the software. To interpret the obtained data, data of HR changes and eye movements during pretest, posttest and intervention were used to investigate different stages of attention capacity especially sustained attention. To understand different phases of sustained attention in these infants, we needed to measure simultaneous changes of heart rate and eye movements. Infants' mere looking at the stimuli cannot be indicative of sustained attention. In fact, this should be accompanied by lowering HR, which indicates examinees' processing information or sustained attention.

Eye movement is measured through measuring infant's eye spinning toward the stimulus as well as total look duration to the screen and total eye sweep to the stimulus displayed on the screen in the study.

Results

To investigate the effect of infant's positioning on variables of total look duration, sustained attention, and orientation, the data was subjected to MANOVA using position (baby on mother's lap versus baby on car seat) and age (4, 6, 8, 10 & 12-month-old) as between-subjects variables. Levine's test did not turn out to be significant thereby supporting the assumption of homogeneity of variance.

The result indicated that there was not an overall main effect of infant's position, Pillai's Trace = 2.027, $P = NS$. Nothing was found on the overall main effect of infant's age on attention variables, Pillai's Trace = 0.536, $P = NS$. This indicates that infants' attention variables did not change across positions and age. Moreover, no significant interactional effect between position, age and attention variables was found, Pillai's Trace = 0.968, $P = NS$. This indicates that examinees did not function differently on any of these three measures in terms of their position.

However, an examination of main effect for the analysis revealed a significant main effect of infant's position on sustained attention, $F(3, 28) = 6.24$, $P = 0.018$, eta-square = 0.17 and on total look duration, $F(3, 28) = 6.032$, $P = 0.020$, Eta Square = 0.167. This indicates that mother's presence can be considered as decreasing factor of infants' stress and irritation; it functions as a controlling factor thereby enhancing infants' attention to the displayed stimulus. A close examination of mean differences (Table 1) indicates that infants in the present sample showed longer sustained attention when they are in their mothers' lap ($M = 9.65$, $SE = 1.27$) than when they are on their special chairs ($M = 5.15$, $SE = 1.04$). Also, the results revealed that infants in mother's lap showed more total look ($M = 26.95$, $SE = 1.51$) than those in their special chairs ($M = 21.7$, $SE = 1.33$). On the other

hand, age did not show any significant effect on total attention categories, Pillai's Trace = 0.53, P = NS.

The results of correlation between duration of sustained attention, duration fortotal look, and orientation indicated that duration of sustained attention was positively and significantly correlated with total look duration ($r = 0.9$, $P < 0.001$, $n=40$), whereas there was no significant relationship between orientation and either of duration of sustained attention or duration of total look. This indicates that orientation functions independently from duration of sustained attention and total look duration. In fact, maybe diverse independent factors might be involved in these measures. However,

considering the fact that correlational study cannot determine cause and effect relationship, theoretically speaking, more total look to the stimuli can be indicative of sustained attention and thereby infants' processing the related information.

To investigate the possible effect of positioning on infants' general irritability, the present data were subjected to the result of chi square (Table 2) revealed that there is a significant difference between infants' general irritability across their positioning, $X (1) = 6.194$, $P = 0.044$. However, infants' general irritability does not differ across age; Fisher exact test did not turn out to be significant; $F = 4.048$, $P = 0.56$.

Table 1. Relationship between orientation, sustain attention, total look duration, and general irritability

		orienting reflex	sustained attention	total look duration	general Irritability
orienting reflex	Pearson Correlation	1	-.123	.141	.017
	P		.448	.386	.918
	N	40	40	40	40
sustained attention	Pearson Correlation	-.123	1	.900**	.429**
	P	.448		.000	.006
	N	40	40	40	40
total look duration	Pearson Correlation	.141	.900**	1	.403**
	P	.386	.000		.010
	N	40	40	40	40
general irritability	Pearson Correlation	.017	.429**	.403**	1
	P	.918	.006	.010	
	N	40	40	40	40

Table 2. Chi Square across age and positioning

	Value	df	P
Pearson Chi-Square	5.625 ^a	1	.044
Likelihood Ratio	6.194	1	.044
Fisher's Exact Test	4.0	4	.56
Linear-by-Linear Association	5.484 ^c	1	.044

Conclusion

The present research is illuminating the importance of infant's positioning in mothers' lap as an appropriate condition for assessing infants' attention capacity. Since, in such situations inattentive factors would be eliminated. We deliberately omitted vocalization, which is the most common technique along with holding and rocking, to avoid double directing infants to get a more lucid interpretation of infants' behavior. This study

revealed a significant difference between infants' duration of sustained attention and total look duration across positions. The results indicated that infants sitting on their mothers' lap enjoyed a higher amount of total look duration and longer sustained attention.

The result can be explicated from two perspectives. The first reason might be due to the supportive role of one of the parents in the site. Mother's presence in the site (15,16) can be considered as an external force of controlling for kids in doing their tasks thereby increasing their duration of focusing attention on the task. As expected, infants in this study take advantage of being seated in their mothers' lap although the present situation has the least intervening effect on examinees attention. Our finding is in line with others finding (5,8,12) who found that maternal soothing behavior is influential in infants' decrease of irritability and increasing attention ability.

The result of this study revealed that mother's presence, while embracing their infants on their lap, in the laboratory decreases infants' stress and thereby increasing the length of their attention to the stimulus. The result is expectable because mothers are confining infants' physical movement. Moreover, the techniques are similar to that of holding/rocking technique and touching technique as two commonly used maternal soothing behaviors when calming their children. Caregivers usually use these two techniques while calming their crying infants and soothing their stress. When mother holds and touches the baby in his arms while sitting him in his lap, the boy/girl experiences the touching situation completely.

Furthermore, as expected, the study revealed that infants' positioning has no significant effect on their either length of or speed of orientation. The indicative factor of speed of orientation is quality of

informative stimuli. Since the age of infants (between 4 to 12 months old), in the present study, can only pay attention to physical features of the stimuli like similarities and differences. Therefore, their processing level is believed to be low and mid (17). Such neonates would follow the stimulus after their first saccade (18,19). Research (18,20-23) indicated infants are able to detect the stimuli correctly irrespective of the specific visual features or degree of speed in the stimuli. The idea is that the first saccade directed the target by child visual search is indicative of perceiving enough interpretation of visual stimuli in the first eye fixation (24). Moreover, the time of first fixation and orientation is influenced by degree of glowing (25) and in contrast of visual stimuli (26).

Furthermore, we found that there is a significant positive relationship between total looks duration and sustained attention, whereas orientation did not turn out to be significantly correlated with neither of the mentioned variables. This indicates that infants with more length of total look time on the displayed stimuli showed longer sustained attention. However, as was stated earlier, changes in reaction time of orientation is independent of the displayed stimuli. Perhaps, in this research, examinees failed to enter the sustained attention phase due to the shortness of the period of displaying stimuli (here a mute animation). Therefore, we expect there should be a ceiling time or threshold for being exposed to dynamic stimuli for an examinee to enter this phase of attention. In line with this study, Colombo failed to find a significant correlation between orientation and sustained attention, but found that duration of look was positively and significantly correlated with sustained attention and attention termination (27). He tried to assess recognition ability through exposing the examinees to static stimuli. We may

conclude there might be a threshold time for a baby to enter sustained attention phase while exposing to a displayed stimulus. This means that probably infants' reactivity might differ across the length of displayed stimulus. It is believed that longer stimuli might be boring and thereby causing child inattentiveness (28). Another reason for failing to find a relationship between orientation and duration of sustained attention might be the limited number of participants in this study. The result may change by including a larger number of participants.

Another result of this study revealed that age, statistically speaking, did not affect duration of sustained attention significantly; however, the duration mean of sustained attention in infants sitting on mother's lap group has decreased with age, although insignificantly. The reason might be that in a one minute show, younger infants are lower in processing speed in comparing with older infants so younger infants didn't have enough time for disengagement. On the other hand, older infants entered the attention termination phase due to their fast processing speed. Moreover, older infants require more complicated stimuli, whereas the stimuli in the present study were only captivating enough for the younger infants. The result of this study is in line with Richard and Courage, Reynolds, and Richards who supported the idea that older infants are more interested in more complex stimuli and thereby processing them faster than younger infants (28,29).

The interesting result is that infants' age, in sitting on baby seat group, did not affect their sustained attention in this predictive manner. In this group duration mean of sustained attention decrease steadily with age increase from 4 months to 8 months. However, in 12 months infants, we observed a sharp increase in duration mean of sustained attention. The presence of such a situation

in this study might be due to the effect of mother and child interaction across age; infants between 4-m and 10-m old show a lower duration of mean in this group. This is indicative of the diverse effects of mother's soothing behavior across ages. In older infants, verbal relation (vocalization) and attention shift are most commonly used methods of maintaining infants' attention while in this study we did not use such methods to prevent intervening variables in investigating infants' attention. We believe that to illuminate the nature of attention, more research is required with a larger number of participants, including more age variation, and across different kinds of stimuli with time variation. Further research is needed to investigate the effect of infants' positioning across ages with more number of participants. Another research can focus on different combinations of non-intervening mothers' soothing behavior across different infants' positioning to achieve the most suitable and less intervening research condition in all ages.

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