Swaddling: a traditional care method rediscovered

Lars Eckehard Meyer, Thomas Erler

Cottbus, Germany

Background: **This study was undertaken to compare the sleep profiles of healthy infants in swaddling and sleeping bag conditions.**

Methods: **Polysomnographs of 85 healthy infants (40 in the study group, 45 in the control group) with a mean age of 7.5 weeks were recorded in the sleeping laboratory. A positive decision from the local Ethics Committee and the written consent of the parents were obtained for the study.**

Results: **Swaddling significantly reduces the rate of spontaneous waking (events/h: 1.39 [0.85-2.77] *vs.* 2.81 [1.49-4.53], *P*=0.020) and the number of sleep stage changes (events/h: 3.82 [2.97-5.16] *vs.* 5.37 [3.58-6.67], *P*=0.015). Swaddling promotes quiet sleep (36.37% [29%-40.31%] *vs.* 30.2% [24.45%-36.78%], *P*=0.032), the time spent awake was decreased (8.98% [4.62%-14.25%] *vs.* 14.17% [9.2%-18.94%], *P*=0.001) and sleep efficiency was increased (91.02% [85.75%-95.38%] *vs.* 85.83% [81.06%-90.8%], *P*=0.001).**

Conclusion: **Swaddling promotes a more quiet sleep in infants.**

World J Pediatr 2011;7(2):155-160

Key words: **infantile regulatory disorder; polysomnography; sudden infant death syndrome; swaddling**

Introduction

Infantile regulatory disorders are common in our society. Clinical experience shows that almost every 4th to 5th child in pediatric treatment suffers from a disorder of this kind.[1] Sleep disorders occur most frequently, followed by feeding disorders and excessive crying.[2] Infants affected by a regulatory disorder, who often wake in the night, sometimes cry excessively, stay awake longer, and need considerably more help in going to sleep, are a great cause of stress for parents.[3] These children are at increased risk of abuse. The parents who themselves suffer from a lack of sleep are prone to emotional outbursts: there is a risk for shaken baby syndrome, an injury with a high mortality rate, whereby almost all survivors suffer from severe neurological and/or cognitive damage.[1,4] A further risk to such children is in the encouragement of an unhealthy sleep pattern. Excessive crying and infantile sleep disorders are the main reasons stated by parents for laying their children in prone sleeping position rather than in supine position.[5,6] Children seem more content when placed prone and are believed to sleep more quietly, so that the parents are not required to intervene so often during the night. However, despite prevention campaigns prone sleeping is a fundamental risk factor for sudden infant death syndrome (SIDS) and continues to be the most frequent post-neonatal cause of death in many industrialised countries such as the USA or Germany.[7,8] Studies have shown that through measures aimed at increasing parents' awareness with regard to their babies' sleeping position the frequency of the prone position and consequently the incidence of SIDS could be decreased by approximately 50%.[9,10]

It therefore seems reasonable to evaluate methods which promote quiet infant sleep in the supine position and therefore relieve overburdened parents. Improved sleep could reduce the risk of child abuse and help to lower the rate of SIDS. Multimodal treatment concepts now exist for infantile regulatory disorder. One strategy for promoting quiet sleep is known as swaddling.[11,12] Some children benefit if their limbs are drawn towards the center of their body for sleeping. They experience a balance, a physical containment, which at the same time makes them feel more secure.

Swaddling is a traditional custom in which infants are wrapped tightly but comfortably in sheets, blankets or similar objects.[13] The limbs are fixed more or less tightly to their body such that the children no longer have complete freedom of movement. Prior to the 18th century, swaddling was a universal care method.

Author Affiliations: Carl-Thiem-Klinikum Cottbus gGmbH, Clinic for Paediatric and Adolescent Medicine, Academic Teaching Hospital of the Charité – Universitätsmedizin Berlin, Cottbus, Germany (Meyer LE, Erler T)

Corresponding Author: Lars E Meyer, Carl-Thiem-Klinikum Cottbus, Klinik für Kinder- und Jugendmedizin, Thiemstr. 111, 03048 Cottbus, Germany (Tel: +49 355 46 2336; Fax: +49 355 46 2077; Email: l.meyer@ctk.de)

doi: 10.1007/s12519-011-0268-6

However, the custom became increasingly forgotten in Europe in the period leading up to the Industrial Revolution. The rejection of swaddling was a reflection of the liberal views then became more widespread in Western European society. Moreover, it was considered unnatural and its practice became confined to the rural population of Eastern Europe. Nevertheless, swaddling is still practised in some cultures in the Middle East and South America and is now enjoying increased popularity in industrialized countries such as the United States, the UK and the Netherlands. The main reason for the revival of swaddling is that babies sleep more quietly. Experimental studies now support this observation that infants subject to swaddling while sleeping tend to wake less frequently, appear to sleep longer and are more likely to return to sleep on their own.[12,14,15]

Increased public interest is demonstrated by an increasing number of publications on the topic of swaddling.[16] Comparisons with the traditional baby sleeping bag are being discussed and the advantages and disadvantages of the method are being weighed up. For example, swaddling promotes neuromuscular development in premature babies, supports self-regulatory mechanisms, and can prevent physical unrest.[17,18] Phases of crying are significantly reduced and, during painful procedures, a comforting effect is observed.[19,20] Swaddling can also assist newborns with cerebral defects and/or withdrawal symptoms.[21,22]

Swaddling seems to be a promising method of care which promotes quiet sleep in infants. Due to this, our study center has been using a swaddling sleeping bag ("Cosyme", Cosyme GmbH, Germany) for putting newborns and infants to bed for approximately two years as an alternative to the traditional sleeping bag which allows their arms to move freely. This uses flexible straps to fix the arms of the infants to their body, thus

Fig. Swaddled infant sleeping in a supine position. Flexible straps allow chest wall excursion and hip movement, and arms are restrained at the side.

creating swaddling conditions (Fig.). The caregivers have since been unanimous in reporting an apparently more peaceful and quieter sleep pattern. Although the number of studies on this topic is increasing, the mechanisms and the effects on infant sleep are largely unclear. The aim of the present study was a polysomnographic comparison of the sleep patterns in infants under swaddling and sleeping bag conditions by way of a prospective controlled randomised study.

Methods

Infants or newborns

Polysomnographs were recorded for 85 infants (50 females, 35 males) with a mean age of 52 (±21) days. The infants were recruited prospectively, taking inclusion and exclusion criteria into consideration, from a larger group of infants as part of an SIDS prevention campaign. Preliminary results of the study had already been published previously.[23]

The infants were required to be clinically healthy at the time of the study and between one and four months of age. The family history did not include any SIDS incident. Excluded were former premature babies and children with a birth weight of less than 2500 g. In line with the current study no other sociological or demographical data were being investigated. The study did not cause any added burden to the subjects and there was no remuneration. A positive decision from the local ethics committee and written consent from the parents or legal guardians were obtained for the study.

Procedures

The polysomnographs were recorded in the Carl-Thiem Clinic sleep laboratory in Cottbus (Dept. of Pediatric and Adolescence Medicine) in accordance with the standardized guidelines of the German Sleep Society (DGSM) for performing polysomnography in infants and older children.[24] These guidelines regulate the conditions of sleeping circumstances, the technical gadgets and which parameters need to be recorded. The patients who were examined in the sleeping laboratory were from cities and the rural areas.

The infants were examined lying in a supine sleeping position and randomized, either in a traditional sleeping bag allowing their arms to move freely (45 subjects in the control group) or a swaddling sleeping bag ("Cosyme", Cosyme GmbH, Germany) with their arms strapped to their body (40 subjects in the "Cosyme" study group). During this study each infant did not use anything other than these sleeping bags. The examination of the infants was prepared in a habitual manner such as feeding, cradling, singing nursery songs. After the measuring sensors were stuck on, the light of the sleeping laboratory was turned off. Either mother or nurse stayed behind until the child fell asleep. If the child happened to wake up during examination, adequate procedures were taken to put the child back to sleep. All polysomonographs were performed under identical conditions and ended only after the child had woken independently. Sixty-four infants were recorded at night (36 infants from the control group, 28 from the study group) and 21 infants were recorded during their afternoon sleep (9 from the control group, 12 from the study group). Numerous variables were recorded continuously and simultaneously: electroencephalogram, electromyogram, electroculogram, electrocardiogram, thoracic impedance, and oronasal airflow using a thermistor. Oxygen saturation was measured over 5 second periods and the mean value was determined. The polysomnographs were recorded digitally using the Alice 3TM system, version 1.20 (Healthdyne, Inc., USA, marketed in Germany by Heinen & Löwenstein) and subsequently validated manually. Sleep was broken down into stages in accordance with the definition by Anders, Emde and Parmelee (Table 1).[25] Table 2 provides an overview of the determined sleep profiles and measured cardio-respiratory parameters.

Statistical analysis

The data were evaluated using the SPSS 12.0 statistics software for Windows (SPSS Inc., USA). The non-parametric Mann-Whitney *U* test was used for the statistical analysis of the parameters measured, with the critical significance level set to $P<0.05$. Values were given as median and inter-quartile range values.

Results

Detailed results are provided in Table 3. In summary, there was no difference in the registration time for all 85 infants. There were only slight differences in the majority of the cardio-respiratory parameters under swaddling and sleeping bag conditions. In particular, there were no important differences in the rate and maximum duration of cases of central or obstructive apnoea. A statistical significance was achieved in the oxygen saturation comparisons, i.e., lower saturation values were found under swaddling conditions than in the control group on the basis of the distribution. However, in both groups, the values were all within the normal range and there was no particular relevance to this finding.

The differences in sleep characteristics are obvious. As shown in Table 3, the swaddling sleep in the supine position compared with sleep in the sleeping bag was accompanied by a significantly higher sleep efficiency (91.02% *vs.* 85.83%; P=0.001). The children experienced fewer sleep stage changes (events n/h: 3.82 *vs.* 5.37; P=0.015) and the rate of spontaneous waking was decreased (events n/h: 1.39 *vs.* 2.81; P=0.02). The

Original article

Table 1. Sleep stages in accordance with the definition by Anders, Emde and Parmelee[25]

Active sleep (AS)	Quiet sleep (QS)
Eyes closed, quick, uncoordinated eye movement	Eyes closed, no quick eye movement
Uneven, quick breathing	Even, quiet breathing
Large heart rate variability	Low heart rate variability only
EEG: theta or theta-delta rhythms, no spindles, low amplitude	EEG: high amplitude, spindles, theta and delta or only delta activity
Active, phaseal movement	Low motoricity

EEG: electroencephalogram.

Table 2. Overview of sleep and cardio-respiratory parameters

Parameters	Definition
Registration time	Time in bed (TIB): time between going to bed (light out) and waking (light on), in minutes.
Total sleep time	Total sleep time (TST): sleep time minus all wake times and intervals, in minutes.
Sleep efficiency	Sleep efficiency index (SEI): the ratio of TST to TIB, stated in percent (SEI = TST/TIB × 100).
Stage change	Number of transitions between consecutive stages including waking. The mean number of stage changes during one hour of TIB is stated.
Wake time	The time which was spent "awake", stated as a percentage of TIB (wake time [%] = wake time [min]/TIB × 100] and the mean number of wake stages in one hour of TIB.
Active sleep (AS)	The time which was spent in AS, stated as a percentage of TIB (AS [%] = AS [min]/TIB × 100) and the mean number of AS stages in one hour of TIB.
Quiet sleep (QS)	The time which was spent in QS, stated as a percentage of TIB (QS [%] = QS [min]/TIB × 100) and the mean number of QS stages in one hour of TIB.
Central apnea	Respiratory pause >7 sec. Interruption of the oronasal airflow and breathing movement in the chest and abdomen.
Obstructive apnea	Respiratory pause >7 sec. Interruption of the oronasal airflow despite ongoing breathing exertion, i.e. breathing movement in the chest and abdomen.

total waking time was reduced (8.98% *vs*. 14.17%; *P*=0.001) in favor of the quiet sleep duration (36.37% *vs*. 30.2%; *P*=0.032). No active sleep displacements were observed.

Discussion

The results of the study confirm the subjective observations that fixing the limbs by means of swaddling leads to quieter sleep than in sleeping bag conditions in which the arms can move freely. The children sleep more deeply and wake less spontaneously. As a result, parental intervention is required less frequently. The children appear to be quieter and more peaceful while sleeping.

The findings are supported by further international publications.[12,23,26] A common explanation for the swaddling phenomenon focuses chiefly on the limited limb movement.[12,14,16] The motor restriction may lead to a decrease in the rate of spontaneous waking via a reduction in the proprioceptive stimuli of the reticular activation system. Moreover, a decrease in the motor activity means that infants can fall asleep again more quickly if they do wake up.[12]

With regard to the cardio-respiratory sleep parameters, there are no relevant differences between the study group and the control group. Although a statistically significant difference in the oxygen saturation was calculated over the entire sleep period, the values for both groups were always within the reference range.

In contrast to these results, published papers and some of our preliminary studies describe changes in the respiratory rate and heart rate, especially during quiet sleep.[11,13,23] The effect of swaddling tightness is under discussion: thoracic compression is intensified with swaddling.[27] As a result, the depth of breathing is restricted. This leads to a reduction in ventilation and oxygen concentration in the blood. As a form of compensation, this causes increased respiratory activity

Table 3. Significant and non-significant differences in the sleep profile and cardio-respiratory characteristics in sleep under swaddling *vs*. sleeping bag conditions

Polysomnographic parameters	Study group "Cosyme" (swaddling)	Control group (sleeping bag)	Significance
Registration time, min	218.50 [187.75-248.25]	226 [204-252]	NS (0.476)
Total sleep time, min	201.25 [179-225.75]	186 [172-227.50]	NS (0.360)
Sleep efficiency in %	91.02 [85.75-95.38]	85.83 [81.06-90.80]	**Sig. (0.001)**
Stage changes, h	3.82 [2.97-5.16]	5.37 [3.58-6.67]	**Sig. (0.015)**
Wake time			
Percentage	8.98 [4.62-14.25]	14.17 [9.20-18.94]	**Sig. (0.001)**
Epochs/h	1.39 [0.85-2.77]	2.81 [1.49-4.53]	**Sig. (0.020)**
AS			
Percentage	54.59 [50.80-60.05]	54.30 [46.68-59.13]	NS (0.492)
Epochs/h	3.45 [2.23-4.92]	3.74 [2.98-5.38]	NS (0.149)
QS			
Percentage	36.37 [29-40.31]	30.20 [24.45-36.78]	**Sig. (0.032)**
Epochs/h	1.54 [1.14-2.34]	1.58 [1.14-2.17]	NS (0.898)
Respiratory rate, min			
AS	33.90 [31.23-39.33]	35.90 [30.40-38.70]	NS (0.958)
QS	34.70 [29.88-38.05]	32.85 [28.78-38.58]	NS (0.457)
Heart rate, min			
AS	139.85 [130.20-147.10]	136.70 [130.10-143.40]	NS (0.348)
QS	134.55 [126.30-144.30]	130.60 [126.30-137.30]	NS (0.108)
Central apnoea			
AS, number/h	1.08 [0.57-2.37]	1.29 [0.53-2.50]	NS (0.895)
AS, sec*	9 [7.38-11.13]	8.50 [7.50-10]	NS (0.620)
QS, number /h	1.38 [0-2.38]	0.87 [0-2.38]	NS (0.571)
QS, sec*	8.50 [0-10.13]	7.50 [0-9.50]	NS (0.154)
Obstructive apnoea			
AS, number/h	0.91 [0-3.09]	0.92 [0-2.03]	NS (0.862)
AS, sec*	8.25 [0-13.25]	9 [0-18.50]	NS (0.469)
QS, number/h	0 [0-0]	0 [0-0.75]	NS (0.383)
QS, sec*	0 [0-0]	0 [0-7]	NS (0.499)
O_2 saturation, %			
AS	98 (97-98)	98 (98-99)	**Sig. (0.009)**
QS	98 (97-98)	98 (98-99)	**Sig. (0.022)**

Values are stated as median and inter-quartile range. Sig: significant (bold); NS: non-significant; AS: active sleep; QS: quiet sleep; *: maximum duration of an episode in seconds.

and involuntarily stimulates the cardiac activity. However, the differences in active and quiet sleep were not adequately explained using this model. The physiological effects of swaddling on the newborn or infant are still not fully understood. It therefore seems appropriate to rule out swaddling for cardio-respiratory compromised children on the basis of the data currently available. There is a lack of data on the medium to long-term effects and there are indications of an increased risk of acute respiratory infections.[16,28] Thermistors which are used to measure the oronasal flow tend to cause artefacts such as pseudo-apnea or pseudo-obstruction. This must be carefully taken into consideration when evaluating the respiratory data.

The restricted freedom of limb movement and the quieter sleep associated with this are to be regarded as reasons for the fact that the risk of SIDS in infants may be minimized in the supine position under swaddling conditions. The infants are less likely to turn themselves onto their stomachs and they become less frequently entangled in loose sheets, pillows etc., which are factors resulting in an increased risk of suffocation.[29] It should be pointed out that the risk of SIDS is increased with a combination of swaddling and the prone position. One study has shown that the prone position alone increases the risk of SIDS by approximately a factor of three and the combination of prone position and swaddling can increase the risk up to twelve folds.[30] One reason for this under discussion is the reduced waking capacity under swaddling conditions.[31,32] Overall, however, swaddling does appear to have a positive effect on the safety of the infant's sleep. This interpretation is supported by prevailing epidemiological data which demonstrate a decreased SIDS risk in the supine position with swaddling compared with the supine position without swaddling.[29,30,33,34] In the light of this information, it seems appropriate only to use swaddling conditions up to an age at which infants can turn themselves independently from the supine position to the prone position. No precise age, however, can be stated.

Further potential effects and disadvantages of swaddling discussed in published literatures, such as the influence on excessively crying infants, the increased risk of promoting dislocation of the hip, the risk of hyperthermia or a vitamin D deficiency, were not taken into account as part of this study. A detailed, up-to-date overview is provided in the publication of van Sleuwen et al in 2007.[16]

This study leads to the following conclusions: swaddling promotes sleep efficiency in healthy infants sleeping in a supine position: The infants wake less frequently and have shorter waking phases, they sleep more deeply and experience fewer sleep stage changes. The infants appear to sleep more quietly and peacefully. The use of a swaddling sleeping bag for infants with difficulties in falling asleep or sleeping through the night as a result of infantile regulatory disorder is a possible alternative to the traditional sleeping bag. The parents are no longer required to intervene as often during the night. For this reason, it could be a promising approach to lowering the child abuse and SIDS rate for such children. Any potential complications should be fully clarified before routine childcare use, and therapeutic use with children that are restless due to pain, infection, etc needs to be verified.

Original article

Authors' statement

Preliminary results of this study have been previously published in the trade journal Somnologie 2009;13:24-28 (Springer Verlag, Germany).

Funding: None.
Ethical approval: A positive decision from the local Ethics Committee as well as written consent from the parents or legal guardians were obtained for the study.
Competing interest: None.
Contributors: Meyer LE wrote the main body of the article under the supervision of Erler T.

References

1 Ludwig-Körner C. Excessive crying. Pädiatrie up2date 2008;2:161-184. [In German]
2 Wurmser H, Papoušek M. Facts and figures of infantile regulatory disorders: database from the Münchener Spezialambulanz. In: Papoušek M, Schieche M, Wurmser H, eds. Regulatory disorders of the early childhood. Bern, Göttingen, Toronto: Hans Huber, 2004: 50-76. [In German]
3 Ziegler M, Wollwerth de Chuquisengo R, Papoušek M. Excessive crying in early infancy. In: Papoušek M, Schieche M, Wurmser H, eds. Regulatory disorders of the early childhood. Bern, Göttingen, Toronto: Hans Huber, 2004: 111-143. [In German]
4 Newton AW, Vandeven AM. Unexplained infant and child death: a review of sudden infant death syndrome, sudden unexplained infant death, and child maltreatment fatalities including shaken baby syndrome. Curr Opin Pediatr 2006;18:196-200.
5 Willinger M, Ko CW, Hoffman HJ, Kessler RC, Corwin MJ. Factors associated with caregivers' choice of infant sleep position, 1994-1998: the National Infant Sleep Position Study. JAMA 2000;283:2135-2142.
6 Ottolini MC, Davis BE, Patel K, Sachs HC, Gershon NB, Moon RY. Prone infant sleeping despite the "Back to Sleep" campaign. Arch Pediatr Adolesc Med 1999;153:512-517.
7 Mathews TJ, Curtin SC, MacDorman MF. Infant mortality statistics from the 1998 period linked birth/infant death data set. Natl Vital Stat Rep 2000;48:1-25.
8 Robert Koch Institut. Focus report: health of children and

adolescent. Berlin, RKI, 2004. [In German]
9 Jorch G, Trowitzsch E, von Kries R, von Bernuth H, Hörnchen H, Schulte-Wisserman H. Epidemiological trends in sudden infant death syndrome. Der Kinderarzt 1994;25:1145-1152. [In German]
10 Lesko SM, Corwin MJ, Vezina RM, Hunt CE, Mandell F, McClain M, et al. Changes in sleep position during infancy: a prospective longitudinal assessment. JAMA 1998;280:336-340.
11 Gerard CM, Harris KA, Thach BT. Physiologic studies on swaddling: an ancient child care practice, which may promote the supine position for infant sleep. J Pediatr 2002;141:398-403.
12 Gerard CM, Harris KA, Thach BT. Spontaneous arousals in supine infants while swaddled and unswaddled during rapid eye movement and quiet sleep. Pediatrics 2002;110:e70.
13 Lipton EL, Steinschneider A, Richmond JB. Swaddling, a child care practice: historical, cultural and experimental observation. Pediatrics 1964;33:212-215.
14 Franco P, Seret N, Van Hees JN, Scaillet S, Groswasser J, Kahn A. Influence of swaddling on sleep and arousal characteristics of healthy infants. Pediatrics 2005;115:1307-1311.
15 Blom MA, van Sleuwen BE, de Vries H, Engelberts AC, L'hoir MP. Health care interventions for excessive crying in infants: regularity with and without swaddling. J Child Health Care 2009;13:161-176.
16 van Sleuwen BE, Engelberts AC, Boere-Boonekamp MM, Kuis W, Schulpen TW, L'Hoir MP. Swaddling: a systematic review. Pediatrics 2007;120:e1097-1106.
17 Short MA, Brooks-Brunn JA, Reeves DS, Yeager J, Thorpe JA. The effects of swaddling versus standard positioning on neuromuscular development in very low birth weight infants. Neonatal Netw 1996;15:25-31.
18 Neu M, Browne JV. Infant physiologic and behavioral organization during swaddled versus unswaddled weighing. J Perinatol 1997;17:193-198.
19 Campos RG. Soothing pain-elicited distress in infants with swaddling and pacifiers. Child Dev 1989;60:781-792.
20 van Sleuwen BE, L'hoir MP, Engelberts AC, Busschers WB, Westers P, Blom MA, et al. Comparison of behavior modification with and without swaddling as interventions for excessive crying. J Pediatr 2006;149:512-517.
21 Ohgi S, Akiyama T, Arisawa K, Shigemori K. Randomised controlled trial of swaddling versus massage in the management of excessive crying in infants with cerebral injuries. Arch Dis Child 2004;89:212-216.
22 Saylor C, Lippa B, Lee G. Drug-exposed infants at home: strategies and supports. Public Health Nurs 1991;8:33-38.
23 Meyer LE, Erler T. Sleep quality in infants—a polysomnographic comparison of swaddling and infant sleep sacks. Somnologie 2009;13:24-28. [In German]
24 Niewerth HJ, Wiater A, Eckardt T, Erler T, Hoch B, Paditz E, et al. Polysomnographic studies for infants and children—laboratory instructions. Somnologie 2000;4:43-52. [In German]
25 Anders T, Emde R, Parmelee AH. A manual of standardized terminology, techniques and criteria for scoring of states of sleep and wakefulness in newborn infants. Los Angeles, California: UCLA Brain Information Service/Brain Research Institute, 1971.
26 Giacoman SL. Hunger and motor restraint on arousal and visual attention in the infant. Child Dev 1971;42:605-614.
27 Kahn A, Rebuffat E, Sottiaux M. Effects of body movement restraint on cardiac response to auditory stimulation in sleeping infants. Acta Paediatr 1992;81:959-961.
28 Yurdakok K, Yavuz T, Taylor CE. Swaddling and acute respiratory infections. Am J Public Health 1990;80:873-875.
29 Wilson CA, Taylor BJ, Laing RM, Williams SM, Mitchell EA. Clothing and bedding and its relevance to sudden infant death syndrome: further results from the New Zealand Cot Death Study. J Paediatr Child Health 1994;30:506-512.
30 Ponsonby AL, Dwyer T, Gibbons LE, Cochrane JA, Wang YG. Factors potentiating the risk of sudden infant death syndrome associated with the prone position. N Engl J Med 1993;329:377-382.
31 Richardson HL, Walker AM, Horne RS. Influence of swaddling experience on spontaneous arousal patterns and autonomic control in sleeping infants. J Pediatr 2010;157:85-91.
32 Richardson HL, Walker AM, Horne RS. Minimizing the risks of sudden infant death syndrome: to swaddle or not to swaddle? J Pediatr 2009;155:475-481.
33 Beal S, Porter C. Sudden infant death syndrome related to climate. Acta Paediatr Scand 1991;80:278-287.
34 van Sleuwen BE, L'Hoir MP, Engelberts AC, Westers P, Schulpen TW. Infant care practices related to cot death in Turkish and Moroccan families in the Netherlands. Arch Dis Child 2003;88:784-788.

Received August 7, 2010
Accepted after revision December 7, 2010