The Birth Shell for the Second Stage of Labour: A Modern Tool to Support Physiological Birth

Dispositif facilitant l'adoption d'une position accroupie pendant le deuxième stade du travail : Un outil moderne pour soutenir l'accouchement physiologique

By Ank de Jonge, PhD; Liselotte Kweekel; Tine Oudshoorn; and Gré Keijzer-Landkroon

INTRODUCTION

Most women in the Western world give birth lying on their backs.[1] This has not always been the case. Before the 17th century, upright positions for giving birth were common; the supine position became common practice only when instruments such as forceps were introduced.[2] In parts of the world where Western culture has not yet had much influence, many women give birth in an upright position.[3] In Western countries, there is a growing awareness that the routine use of the supine position may have disadvantages.[4] In its practical guide, Care in Normal Birth, the World Health Organization recommends that women be encouraged to adopt positions that are comfortable.[5]

Almost 30 years ago, Gré Keijzer-Landkroon, a Dutch independent midwife and one of the authors of this article, read about the advantages of vertical childbirth. She visited non-Western countries and noticed that people squat for working activities, toilet visits, and childbirth; they keep their heels in contact with the ground, thus letting the entire length of the feet carry the full body weight (Figures 2 and 3). Keijzer-Landkroon wondered whether this position would also be suitable for Western women during the second stage of labour. However, Western women are not accustomed to squatting and cannot maintain such a position for a long time. Since 1984, Keijzer-Landkroon has experimented with squatting positions and has discovered that a heel support with a height of four centimetres enables a woman to squat while the entire length of the foot carries her full body weight (Figure 4).

Figure 1

Figure 2

Keijzer-Landkroon and an industrial engineering student at Delft Technical University, combining new insights and knowledge regarding physiological birth and ergonometric evidence, developed a birth tool called the "birth shell" to facilitate squatting on ergonomic terms(Figures 5 and 6).

The Birth Shell And Heel Support

The birth shell is a hard plastic device weighing three kilograms and measuring 74 by 75 centimetres with an integrated heel support that enables a woman to squat while giving birth. It is slightly sloped at the back so that a woman can lean against it with her sacrum during resting periods between contractions. A separate small backrest is needed to

achieve a truly comfortable and relaxing position. It is usually placed on the bed, facilitating hygienic circumstances and good working conditions for midwives. Between contractions, the woman can rest by leaning against a backrest (Figure 7) or by leaning forward over something such as a baby bathtub turned upside down with a pillow on top of it (Figure 8). Alternatively, the birth shell can be used on the floor. Between contractions, the woman will need to stand up to restore blood circulation in the legs.

When Keijzer-Landkroon first started using the heel support, she sometimes noticed a reduced muscle tone in babies and the quick passage of meconium soon after birth. She also learned that squatting for a long time, without using other positions intermittently, can lead to symptoms of "drop foot."[6] One of her clients did not want to adopt relaxing positions between contractions and squatted for 40 minutes. Afterward, the client experienced a numb tingling sensation on her right shin; the sensation disappeared after six months. Keijzer-Landkroon set out to learn more about pelvic anatomy and about how women in non-Western countries use the squatting position. She observed that if left undisturbed, non-Western women often remain walking and standing during the second stage of labour and squat spontaneously only when the head reaches the pelvic floor. When a woman is standing, her hip joints are fully stretched and the conjugata vera pelvis is at its maximum length; this widens the pelvic inlet. When the head reaches the pelvic floor, the pelvic outlet needs to widen. Flexing the hip joints in a squatting position increases the distance between the ischial spines and therefore the size of the outlet.[7]

Because of her new knowledge, Keijzer-Landkroon started to avoid encouraging women to squat until the head was sliding over the perineum; this results in a primiparous woman squatting usually no longer than 10 to 13 minutes. Keijzer-Landkroon now emphasizes that allowing women to follow their own intuitions and feelings in regard to when and how forcefully to push may lead to better stretching of the perineum.[8] When the head is crowning, most women will instinctively lean backward or will be advised to do so. This enlarges the angle in the hip joints and creates room for the baby's shoulders to pass the pelvic inlet.

Keijzer-Landkroon started using heel support in 1985 and has used the birth shell since 1991. After several years, she had the impression that she was using fundal pressure less often and was performing fewer episiotomies when women were squatting or in standing positions. She decided to keep records of all of the births she attended to monitor labour outcomes in order to evaluate her practice.

Using the chi-square and Fisher exact tests for analysis, we compared some labour outcomes before and after Keijzer-Landkroon started using squatting and standing positions in combination with the heel support and the birth shell (Table 1). A p value of less than .05 was considered to be statistically significant. Only primiparous women at term who were in Keijzer-Landkroon's care at the onset of the second stage of labour were included. These women had a low risk of complications.

Figure 3

Figure 4

Figure 5

Figure 6

After she started using the heel support, only 28 out of 322 primiparous women gave birth in a non-squatting position, i.e. on the birthing stool or in recumbent position. From these births, Keijzer-Landkroon only recorded whether a woman was referred or not and the indication for referral. The referral rate for failure to progress or for fetal distress during the second stage of labour did not change significantly after Keijzer-Landkroon started using the birth shell. Among women with infants weighing more than 3.5 kilograms, there was a small nonsignificant reduction. Fundal expression was used significantly less frequently. The episiotomy rate decreased, and the rates of second-degree and labial tears increased. The intact perineum rate did not change significantly. No significant differences were found in the rate of postpartum hemorrhage or neonatal problems that could be related to the birth and home birth.

Comparison With National Labour Outcomes

We compared the labour outcomes of Keijzer-Landkroon's births after she started using the birth shell with national labour outcomes from 1994 to 2004 (Table 2). (No reliable national data were available on the specific outcomes of interest before 1994.) Data were extracted from the Netherlands Perinatal Registry. We compared the outcomes of all primiparous women who were in midwife-led care at the onset of the second stage of labour in both sets of data. Keijzer-Landkroon's referral rate for failure to progress or fetal distress was significantly lower than the national average. Her episiotomy rate was also lower, and her intact perineum rate was higher. More women in

Table 1: **Outcomes of labour among primigravidas in primary midwifery care at the onset of the second stage of labour before and after the introduction of heel support/ the birth shell (Keijzer-Landkroon's clients)**

	1974 to 1984: recumbent position during second stage of labour (N=103)	1985 to 2004: use of birthing shell during second stage of labour (N=322)	P
Referral during second stage for failure to progress or foetal distress n (%)±			
All cases	10 (9.7)	28 (8.7)	.754
Children over 3.5 kg	7 (15.9)	7 (6.1)	.063
Interventions during second stage of labour			
Fundal expression	16 (15.5)	9 (3.1)	< .001
Vacuum/ forceps/ caesarean section	8 (7.8)	23 (7.8)	.985
Perineum¥			
Intact perineum	39 (41.9)	106 (39.3)	650
Labial tear	0 (0)	28 (10.4)	.001
Second degree tear	21 (22.6)	106 (39.3)	.004
Anal sphincter damage	0 (0)	5 (1.9)	.334
Episiotomy	33 (35.5)	25 (9.3)	< .001
Total blood loss¥			
≤ 500 mls	86 (92.5)	238 (88.1)	
501-1000 mls	5 (5.4)	29 (10.7)	.245‡
> 1000 mls	2 (2.2)	3 (1.1)	
Neonatal problems, possibly birth related±	5 (4.9)	6 (2.0)	.162
Place of birth±			
Home	66 (64.1)	212 (72.1)	
Hospital	37 (35.9)	82 (27.9)	.126

Missing values are excluded.
* Total group of women.
† Only women who gave birth in primary care (1974–1984, N = 93; 1985–2004, N = 294); for 24 women, no information on perineal damage or blood loss was available. For every woman, only one perineal condition is registered in the following hierarchy: anal sphincter damage, episiotomy, second-degree tear, labial tear, intact perineum.
‡ Blood loss ≤ 500 mL vs. blood loss > 500 mL.
§ Neonatal problems include asphyxia, breathing problems, circulation problems, clavicula fracture, cephalhematoma.

about

the artist

Brescia "brixia" Nember-Reid is a Toronto-based artist/performer and birth-enthusiast. Her work has recently been featured in *Broken Pencil* magazine & in Rhubarb Festival. Brescia is currently studying in the Midwifery Education Program at Ryerson University. She is a graduate of the Assaulted Women and Children's Counselor/Advocate program at George Brown College, and the Expressive Arts Certificate program at Haliburton School of the Arts.

the art

My interest is in crafting creative explorations of birth-related information. Delving in with an imaginative lens, I aim to highlight fascinating aspects of bodies, societal customs, and emotional processes. I seek to share midwifery and birth lore, through interpretive illustration.

I came upon the historical connection between stork sewing scissors and umbilical cord clamps randomly, while conducting other school research on the internet. The illustrations in this work are based on online photographs of scissors & clamps, found on eBay and Google Images/ Answers. Through this, I was led to explore some of the mythology regarding storks and birth, uncovering the ethereal association between swamps and souls. This association can be seen in Hans Christian Anderson's story, "The Storks", published in 1838. A grain of truth is sometimes all that the human imagination requires.

The work shown here is an exert from her zine, entitled "Stork Scissor Story" (2012). Other works include an illustrated booklet exploring the placenta, entitled "Where Have All The Placentas Gone?" (2008). For more information, please contact: myplacenta@gmail.com.

Stork Scissor Story.

(Tool of Midwives.)

by: Brescia "brixia" Nember-Reid

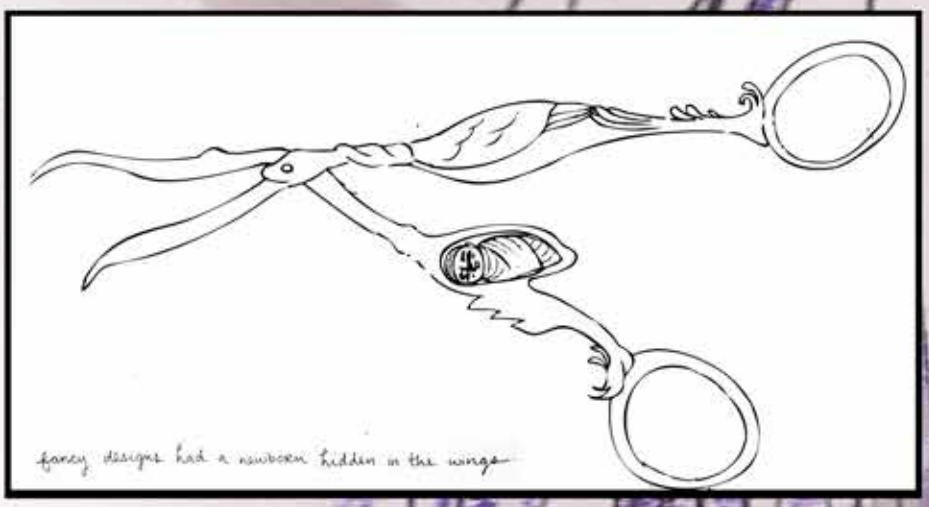
Stork scissors are known for their sharp points, ideal for detailled sewing and Embroidery work.

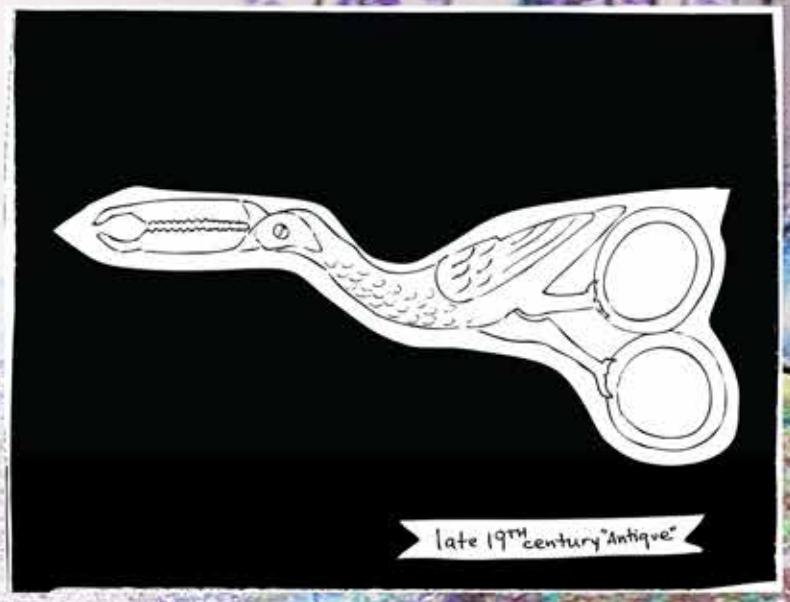
The stork scissors of today are descendants from Umbilical clamps used by some Midwives in Europe in the 1800s.

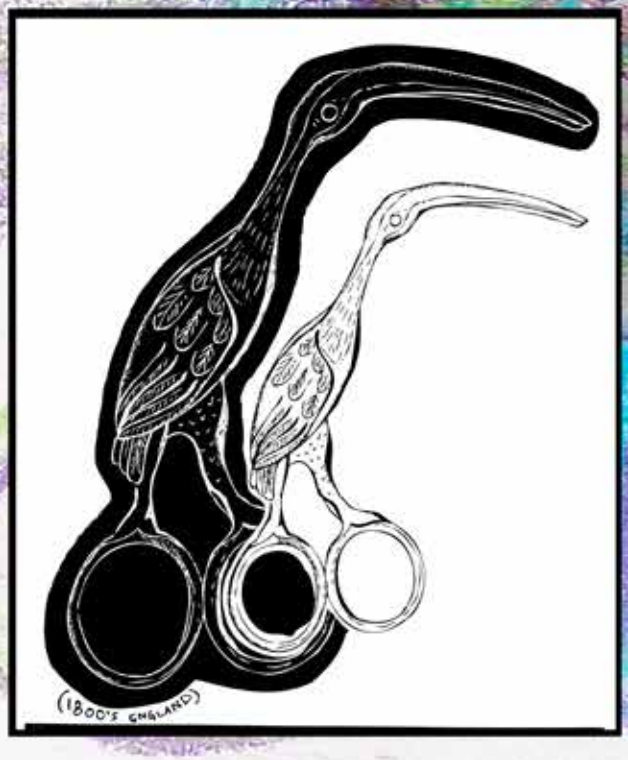
Midwives often brought sewing / needle work along to births.

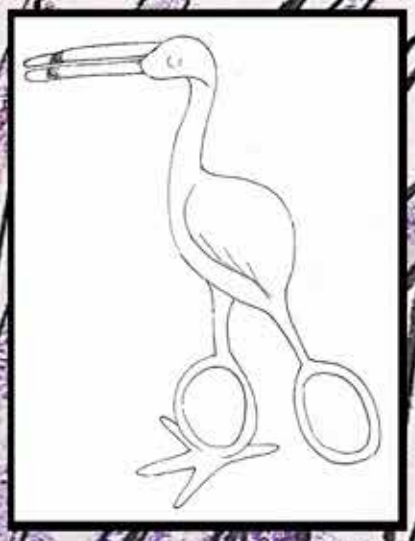
In this way, the umbilical clamps are said to have migrated into sewing boxes.

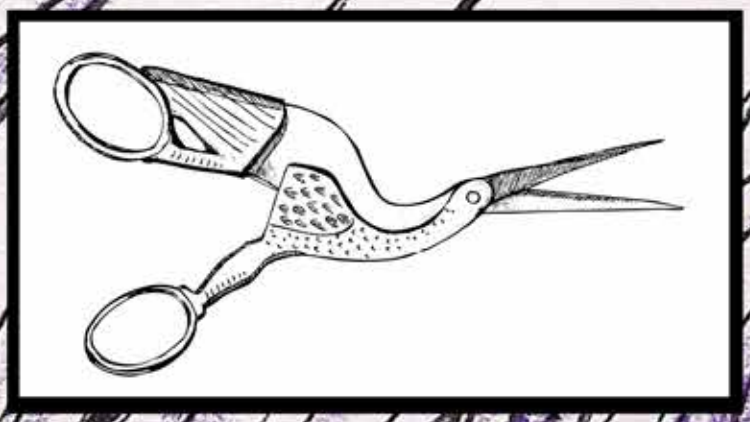
stork pattern clamps to tie off the umbilical cord after someone gave birth...

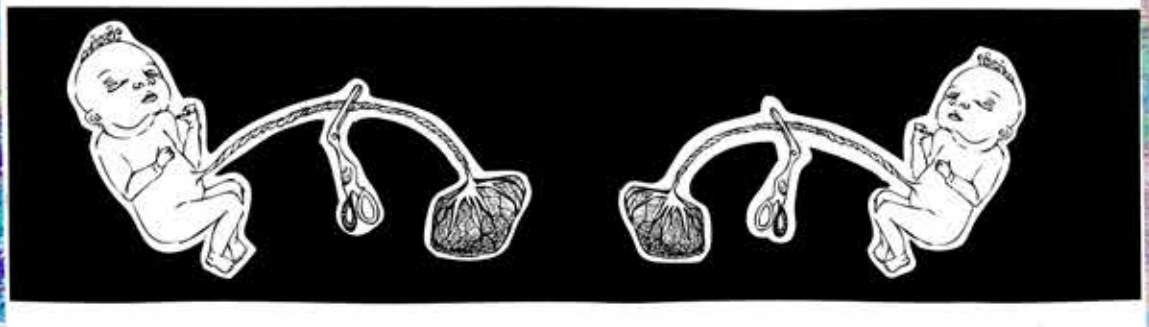

fancy designs had a newborn hidden in the wings


late 19TH century "Antique"


(1800's ENGLAND)








Hans Christian Anderson's story "The Storks" tells that actual babies wait, dreaming, in wetlands, marshes, + swamps, until it is time for them to be born. Then, the Storks deliver the babies to new homes.
Other Mythology tells the Storks ferry Souls from wetlands to the bodies of newborn babies.

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Keijzer-Landkroon's care gave birth at home. No significant differences were found in the rate of blood loss greater than 500 millilitres.

DISCUSSION

The results of the analyses should be interpreted with caution. The data from births using heel support and the birth shell were collected from one midwife only and compared in a before-and-after analysis. In addition, the number of births was small, and the births were spread out over a large number of years. During those years, many things may have changed in practice; this limits the comparison between births before and after the introduction of the heel support and birth shell. The number of referrals during the second stage of labour for failure to progress or fetal distress did not change significantly after Keijzer-Landkroon started using the heel support and birth shell. Two randomized controlled trials indicated a shorter second stage for women in the squatting position,[9,10] and one of these found a decrease in the need for augmentation of labour during the second stage.[10] A reduction in instrumental deliveries in the squatting position as compared to the semi-recumbent position was found in the first study[9] and was not significant in the second study.[10] Another study comparing the use of a squat stool in birth with giving birth in a recumbent position showed no difference in the duration of labour or instrumental deliveries.[11] The type of squatting position varied among the studies mentioned, but none of them involved the birth shell.

Among the women attended to by Keijzer-Landkroon before and after the introduction of supported squatting, the use of fundal expression to aid the birth of the baby was significantly reduced. Keijzer-Landkroon initially used fundal expression rather than referral if progress was slow, which may explain why the referral rate did not change after the introduction of the heel support and birth

Table 2: **Outcomes of labour among primigravidas in primary midwifery care at the onset of the second stage of labour: Keijzer's patients using the birth shell compared to national data**

	1994 to 2004: use of birthing shell during second stage of labour (N=114)	1994 to 2004: national data (307,101) §	P
Referral during second stage for failure to progress or foetal distress n (%)±	9 (7.9)	52,669 (17.2)	.009
Perineum¥			
Intact perineum	38 (38.4)	48716 (20.0)	< .001
Labial tear	13 (13.1)	24194 (9.9)	.286
Second degree tear	33 (33.3)	82110 (33.7)	.920
Anal sphincter damage	3 (3.0)	8060 (3.3)	nc
Episiotomy	12 (12.1)	80710 (33.1)	< .001
Total blood loss¥, ⌂			
≤ 500 mls	86 (86.9)	205097 (84.3)	
501-1000 mls	13 (13.1)	31569 (13.0)	.484
> 1000 mls	0	6567 (2.7)	
Place of birth±			
Home	79 (73.1)	160,519 (52.7)	<.001
Hospital	29 (26.9)	144,256 (47.3)	

Missing values are excluded.

* Data from the Netherlands Perinatal Registry.

† Total group of women.

‡ Only women who gave birth in primary care (1994–2004, N = 105); for 6 women, no information on perineal damage or blood loss was available (national data, N = 243,790).

§ nc = not calculated: chi-square test not possible because expected value < 5 in one cell; Fisher exact test not possible because of large sample size.

|| Blood loss ≤ 500 mL vs. blood loss > 500 mL.

shell, even though the rate of fundal expression was reduced. The use of fundal pressure is controversial. It is used by some practitioners to avoid a prolonged second stage of labour and instrumental delivery.[12,13] In the Netherlands, the method is used quite frequently in secondary care (4.9%).[14] Some primary care midwives use it to achieve spontaneous birth; others use it only in case of severe fetal distress, particularly in the home situation. A Cochrane Review identified no good quality randomized controlled trials on manual fundal pressure.[15] Merhi and Awonuga recommended considering alternative management strategies whenever possible because of the lack of proven benefit of fundal pressure and the potential adverse effects, such as uterine rupture and severe perineal trauma.[13] Although they did not mention upright birth positions, Keijzer-Landkroon's data show that a standing and squatting position may also be used as an alternative to fundal pressure.

Among women who had a baby weighing more than 3.5 kilograms, the rate of referral during the second stage was lower, but this was not significant, possibly because of the small sample size. To show a difference between 16% and 6% with a power of 80% and a significance level of .05, there would need to be 152 women in each group. It is likely that the effects of gravity and increased pelvic dimensions in upright positions are most useful when the baby is relatively large.

Once Keijzer-Landkroon started using the birth shell, the episiotomy rate decreased, the rate of second-degree tears increased, and no significant difference was found in the rate of intact perineum. There is some evidence that perineal tears lead to fewer complications than episiotomies.[16,17] Other studies have found higher or similar rates of intact perineum in squatting versus a recumbent position.[9–11,18] An increase in labial tears in squatting position was also found in another study.[9] This may be caused by a more anterior transit of the fetal head; therefore, care should be taken not to lift the baby up too rapidly at birth.[9]

In view of the current evidence, the risk of perineal damage does not appear to be a reason to recommend or discourage a squatting position either with or without use of the birth shell.

Compared to the national average from 1994 to 2004, Keijzer-Landkroon had a lower rate of referral during the second stage, a lower episiotomy rate, and higher intact perineum and home birth rates. However, apart from the episiotomy rate, these outcomes were not significantly different among Keijzer-Landkroon's births before and after she introduced the heel support and birth shell. Therefore, it is possible that other characteristics of Keijzer-Landkroon's care or differences in her clients explain the differences between Keijzer-Landkroon's study sample data and national data.

Despite the limitations of the study, the findings show that the birth shell may be an important tool for women. However, the birth shell is not popular in the Netherlands, although a few midwives there still use it. In a previous Dutch study among eight primary care midwifery

Figure 7

Figures 8, 9 and 10

Figure 11