

## **5.2.2 DESCRIPTION OF ORAL FEEDING SKILLS OF PREMATURE SUBJECTS**

The evaluation of the oral feeding skills of the subjects starts on page 4 of the FEFARI (Appendix A) under the heading: Evaluation of the feeding process. The evaluation is done in two parts namely: **Oral structure at rest** (page 4 of the FEFARI) as discussed above and **Functioning of the oral structure** (Page 5 of the FEFARI). The functioning of the oral structures is further divided into the following subheadings: *Non-Nutritive Sucking* (page 5 in FEFARI) and *Nutritive sucking* (page 6 FEFARI)

The Nutritive sucking skills are evaluated according to the four different phases of deglutition, namely the oral-preparatory/oral phase, the pharyngeal phase and the oesophageal phase.

### **5.2.2.1 Non-Nutritive Sucking (NNS) Skills**

The information for this section of the evaluation was obtained by observation and was recorded on page 5 of the FEFARI (Appendix A) under the heading: Non-Nutritive Sucking (NNS). A numerical score of 1 was awarded for normal skill or behaviour, 2 was awarded if the item (skill) was considered moderately abnormal and disorganised. A numerical value of 3 was awarded if the skill was considered severely abnormal and dysfunctional (also see par. 4.4.1.3.).

Generally, it can be stated that the subjects did not experience many problems in this subsection. The younger the group, the fewer difficulties were displayed. The results are summarized in Table 5.7.

**Table 5.7 Problems experienced with NNS**

GROUP	N=9		N=7		N=10		N=10		N=36			
	Group 1		Group 2		Group 3		Group 4		TOTAL Group			
SCORE	2	3	2	3	2	3	2	3	2		3	
Lips: Pursing	1	1	1	0	0	0	0	2	2	5.50%	3	8.30%
Lips: Closure	1	0	1	0	2	0	5	0	9	25.0%	0	0
Lips: closure sustained	1	1	1	2	4	0	3	2	9	25.0%	5	13.90%
T/elevated tip/retracted	1	1	1	1	2	0	1	1	5	13.90%	3	8.30%
Sucking bursts	1	4	2	2	4	1	4	3	11	30.50%	10	27.8%
Rate of movement	2	0	2	1	1	1	5	2	10	27.80%	2	5.50%

According to Table 5.7, the two younger groups displayed very few problems with NNS, except with weak sucking bursts in 4 out of the 9 (44%) of the subjects in Group 1. Group 3 also had problems with sucking burst, which were prolonged or short, rather than weak. A further 40% of these subjects had difficulty in sustaining lip closure for more than 2 minutes around the pacifier. Group 4 had 3 subjects (30%) who could not sustain the closure for more than 2 minutes and 2 subjects (20%) who could not even sustain it that long. Half of the subjects of Group 4 displayed uncoordinated movements during NNS. It seems that, in the group as a whole, the problems experienced with NNS fall more into the moderately disorganised category than in the severely dysfunctional category.

It is interesting that NNS skills seem to deteriorate with maturation. A possible explanation may be that the sucking reflex may diminish over time if it is not stimulated in the premature infants (Morris, 1989). This has definite service delivery implications for providing sucking experience (Brake et al., 1988). Another explanation may be that since the older group were exposed to bottle-feeding more than the other groups, they were more disorganised with the difference between the sucking rates of NNS and NS. In full-term infants, the adaptation between the two different mechanisms of sucking does not cause any problems.

In conclusion, it can be said that the subjects experienced mild problems with NNS.

### **5.2.2.2 Nutritive Sucking (NS)**

Nutritive sucking during bottle-feeding and cup-feeding was evaluated according to the different phases of deglutition. The information obtained for bottle-feeding was entered on pages 6-8 under the heading: Nutritive Sucking, and for cup-feeding on pages 9-11 under the same heading of the FEFARI (Appendix A).

#### **. 1 Oral Preparatory / Oral Phase**

The information regarding this phase was recorded under the subheading: Oral preparatory/oral phase on page 6 for bottle-feeding and on page 9 for cup-feeding of the FEFARI.

The skills of the subjects are discussed according to the different subject groups and the group as a whole. Bottle- and cup-feeding will be compared. The phase will further be discussed according to the structures involved in this phase, namely the lips, jaw and tongue and the triggering of swallowing.

#### **□ Group 1 (34 weeks gestational age)**

The problems in both bottle- and cup-feeding can be classified as moderate, disorganised (score: 2), or severe, dysfunctional (score: 3). The results of the oral feeding skills during the oral preparatory/oral phase during bottle- and cup-feeding for this group are summarized in Table 5.8. The mean values for each oral structure and the comparison between the two feeding methods in terms of the p-value and the level of significance are presented in Table 5.9.

**Table 5.8 Problems experienced by Group 1 during the oral/oral preparatory phase**

Score	GROUP 1: (34 weeks) N=10			
	2		3	
Feeding Method	Bottle	Cup	Bottle	Cup
LIPS / Pursing	0	1	2	1
Closure	1	2	1	1
Maintain	3	6	0	1
Loss of Liquid	0	1	0	3
Movement/ Arrhythmic	5	5	0	4
" / Uncoordinated	7	5	0	2
JAW / Depression	3	6	0	0
" / movement / Arrhythmic	5	7	0	1
" / " / minimal / absent	5	8	0	0
" / " / Lack Rate Change	6	6	0	1
TONGUE /movement / protrusion	0	3	1	0
" / " / elevated / retracted	0	0	1	0
" / " / arrhythmic / weak	4	6	1	3
Sucking bursts	8	6	2	4
Flow rate	7	5	0	1
Bolus formation	2	4	0	0
SWALLOWING/uncoordinated / absent	5	4	0	0
" / delayed / absent	2	3	0	0
" / multiple / no	5	5	0	0
<b>TOTAL</b>	68	90	8	20
<b>2+3</b>	76	110		

The results are discussed according to the information and structure of Table 5.8.

## LIPS

*Bottle:* During bottle-feeding, arrhythmic and uncoordinated movements occurred in 50% and 70% of the cases, respectively.

*Cup:* During cup-feeding 50% of the subjects displayed arrhythmic movements, 50% uncoordinated movements and an additional 40% no movement of the lips. Moderate loss of liquid in 60% and severe loss in 10% of the cases also occurred during cup-feeding. Arrhythmic and uncoordinated movements were expected (Bu'Lock et al., 1990)

Although subjects seem to display more problems with movement of the lips and loss of liquid during cup-feeding, the difference in the mean score for lips between the two feeding methods, had a p-value of 0.078 and is therefore not statistically significant in this age group (Table 5.9).

**Table 5.9 Comparison between bottle- and cup-feeding in Group 1**

	Group 1 N=10					
	BOTTLE		CUP		BOTTLE - CUP	
	Mean	SD	Mean	SD	p-Value	Level of significance
Lips	8.4	2.63	10.8	2.46	0.078	None
Jaw	5.9	1.6	7.1	1.45	0.031	5%
Tongue	1	1.7	10.8	1.47	0.219	None
Swallowing	5.4	1.35	5.6	1.07	0.561	None

## JAW

*Bottle:* The problems which occurred the most during bottle-feeding in this age group (Table 5.8) are, arrhythmic movements, minimal excursion and lack of rate change between NNS and NS (about 50% of the subjects in each of the items)

*Cup:* Additional problems occurred during cup-feeding, namely 60% of the subjects also found it difficult to initiate depression of the jaw, and 20-30% more infants had difficulties with rhythm and movement of the jaw than during bottle-feeding (Table 5.8).

The p-value for the difference in the total jaw score for bottle- and cup-feeding was 0.031 and therefore has a 5% level of significance (Table 5.9). Infants in the 34-weeks age group had **significantly** more problems with jaw movements during cup-feeding.

## TONGUE

*Bottle:* 80% of the subjects experienced problems with prolonged or short sucking bursts and the remaining 20% displayed no sucking bursts. The flow rate was understandably poor. Half of the subjects also demonstrated arrhythmic tongue movements (Table 5.8).

*Cup:* All subjects experienced problems with sucking bursts, 60% were short and 40% demonstrated no sucking bursts at all. Only 1 subject (10%) had strong rhythmic tongue movement, 60% displayed arrhythmic and 40% very weak movements (Table 5.8). These findings support the statement of Comrie & Helm (1997), that premature infants have limited tongue functioning. According to them, short sucking bursts are an indication of a swallowing dysfunction.

Although the p-value (0.21) for the mean score for tongue movements implies that the difference between bottle- and cup-feeding with regard to the tongue is not statistically significant, rhythmic tongue movements do seem to be better during bottle-feeding (Table 5.9).

## SWALLOWING

*Bottle:* Half of the subjects experienced problems with the coordination of swallowing with breathing. Multiple swallows occurred in half of the subjects and 20% of the subjects had a delayed swallow and 20% slow bolus formation (see Table 5.8).

*Cup:* The subjects displayed basically the same problems than with bottle-feeding except for bolus formation which was slow in 40% of the subjects (Table 5.8). Swallowing displayed many problems which may tie in with the short sucking bursts as mentioned by Comrie & Helm (1997) and Wolf & Glass (1991).



The difference in swallowing skills between the two feeding method was not statistically significant in Group 1 (see Table 5.9). Thus, in terms of swallowing, the subjects experienced the same kind of problems, whether they were fed by bottle or cup.

**In summary, the oral feeding skills during the oral preparatory/oral phase of Group 1 can be described as follows:**

**Lips** could be pursed to initiate feeding, as well as closed and the closure maintained to avoid loss of liquid. This does not support the view of Morris & Klein (1987) that premature infants have a decreased lipseal due to weak oral muscles, resulting in liquid loss. During cup-feeding, however, maintenance of the closure was problematic. Although in this group open lips at rest occurred the most, this fact did not seem to affect the proper closure of the lips in functioning. The movement of the lips were, however, arrhythmic and uncoordinated.

Although the lips could close relatively well, depression of the **jaw** seemed to be problematic (more so for cup-feeding) and mainly minimal excursions could be performed during oral feeding by subjects in this age group. This supports the statement by Wolf & Glass (1991) that abnormal jaw and tongue movements occur at this age. Rhythm and coordination of the jaw were problematic, as well as the maintenance of a rate of 1 suck per second.

Generally, the **tongue** of this age group could form a central groove to direct the bolus in an anterior-posterior movement to the pharynx, but rhythm in this oral structure was also affected and, relating to that, the sucking bursts. These sucking bursts tended to be short or even absent, especially in cup-feeding. Due to the short sucking bursts, the flow rate was poor. This finding supports the statements of Brake et al. (1988) that premature infants suck with less force and that the sucking bursts are short and disorganised. Wolf & Glass (1991) also regarded their sucking bursts as short. This group had the highest number of

subjects with BPD, and therefore supports the view of Wolf & Glass (1991) that infants with respiratory difficulties are unable to sustain long sucking bursts.

The **swallowing** in this age group was uncoordinated and multiple swallows occurred approximately half of the time during both feeding methods. This was the group with the highest incidence of BPD and pneumonia and lowest current weight. The short sucking bursts and multiple swallows may be an attempt by the infants to protect a vulnerable respiratory system, and/or may be due to the lack of strength to perform one effective swallow (Comrie & Helm, 1997). On the other hand, rhythm and coordination during oral feeding are generally problematic, due maybe to the neuro-behavioural immaturity of this age group (Brake et al., 1988; Morris & Klein, 1987).

Although Arvedson & Brodsky (1993) consider the oral feeding skills of this age group as efficient enough to sustain oral feeding needs and a sustained weight, the results of this study imply that not all of these infants are ready for total oral feeding, but may still need partial tube feeding.

It can be stated that although higher scores were recorded over the whole phase for cup-feeding, implying weaker oral feeding skills during cup-feeding, the difference in the mean score for every structure between the two feeding methods was not **statistically significant**, except for **jaw movements** (Table 5.8).

□ **Group 2 (35 weeks gestational age)**

The results for this group are summarized in Table 5.9. A comparison between the mean scores of bottle and cup-feeding, the p-values and level of significance, are presented in Table 5.10.



**Table 5.10 Problems experienced by Group 2 during the oral/oral preparatory phase**

	Group 2 (35 weeks)			
	2		3	
	Bottle N=10	Cup N=11	Bottle	Cup
<b>LIPS</b> / Pursing	1	2	0	1
Closure	1	3	0	1
Maintain	0	6	1	2
Loss of Liquid	0	6	0	3
Movement / Arrhythmic	3	5	0	4
" / Uncoordinated	3	3	0	3
<b>JAW</b> / Depression	2	7	0	1
" / Movement / Arrhythmic	3	7	0	2
" / " / Minimal / absent	2	8	0	1
" / " / Lack rate change	2	6	0	3
<b>TONGUE</b> / movement / protrusion	3	1	0	3
" / " / Elevated / retracted	0	2	0	1
" / " / Arrhythmic / weak	3	6	0	3
Sucking bursts	8	6	1	5
Flow rate	5	6	0	1
Bolus formation	4	2	0	1
<b>SWALLOWING</b> / uncoordinated / absent	3	5	0	1
" / Delayed / absent	4	2	0	1
" / Multiple / no	3	7	0	1
<b>TOTAL</b>	50	90	2	38
<b>2+3</b>	52	128		

The oral feeding skills in this group can be categorised as moderately disorganised. Sucking bursts in bottle-feeding and jaw movements in cup-feeding were responsible for most of the feeding problems during the oral preparatory/oral phase in this group

The results are discussed according to the information and structure of Table 5.10.

## LIPS

*Bottle:* Good functioning of the lips was generally demonstrated. However, 30% of the subjects experienced problems with coordination and rhythmic movements of the lips (Table 5.10).

*Cup*: Moderate (in 55% of the subjects) to severe (in 30% of the subjects) liquid loss was a serious problem, as 85% of the subjects experienced liquid loss which may have an impact on their calorie intake. The second biggest problem was the maintenance of lip closure. 55% of the subjects had difficulty in maintaining closure for more than 2 minutes and another 20% could maintain closure for less than 2 minutes. So, although the subjects could open the lips to initiate the feeding, the closure could not be maintained, resulting in liquid loss. Another explanation for liquid loss is that if an infant experiences a bolus as too large, he/she would rather “squirt” it out than risk aspiration due to poor and uncoordinated swallowing which may be present (Comrie & Helm, 1997). Arrhythmic (45% of subjects) and no rhythmic (36% of subjects) movements of the lips were problematic as well. Uncoordinated and weak lip movements each occurred in 27% of the subjects (see Table 5.10).

The p-value for the mean scores of the lip section for the two feeding methods was 0.0078, which means the difference was **highly significant** (1%) in favour of bottle-feeding (see Table 5.11).

**Table 5.11. The comparison between bottle- and cup-feeding in Group 2**

	Group 2 (35 weeks) N=10					
	BOTTLE		CUP		BOTTLE – CUP	
	Mean	SD	Mean	SD	p-Value	Level of significance
Lips	6.9	1.286	10.8	3.027	0.0078	1%
Jaw	5.1	1.663	7.81	2.316	0.0156	5%
Tongue	9.3	1.494	11.45	3.21	0.0368	5%
Swallowing	5.4	1.429	6.18	2.359	0.560	None

## JAW

*Bottle*: Few problems with jaw movements were displayed. Between 20 and 30% of the subjects had difficulties with rhythmic and coordinated movements, to

change the rate between NNS and NS and to initiate jaw depression (see Table 5.10).

*Cup:* The main problem was minimal jaw excursion (in 72% of the subjects). Arrhythmic (in 63% of the subjects) or no movements (18% of subjects) of the jaw, difficulty to initiate jaw depression (64%), lack of rate change between NNS and NS (55%), or the total absence of movement (27%), were also displayed (Table 5.10).

The difference between bottle- and cup-feeding is **statistically significant** at a level of 5%, according to the p-value, which is 0.0156 (Table 5.11). This implies that the subjects in this group managed bottle-feeding better than cup-feeding in terms of jaw functioning. The jaw may be naturally more adapted to function effectively around a nipple than with the relatively flat surface of the cup.

## TONGUE

*Bottle:* Sucking bursts were responsible for the most difficulties (90% of the subjects). These sucking bursts were either prolonged (30% of the cases), too short (50% of the cases), or absent (10%). Therefore, the flow rate was poor and the bolus formation slow, as could be expected from the short sucking bursts (see Table 5.10).

*Cup:* Similar to bottle-feeding sucking bursts were responsible for the majority of problems in cup-feeding - 54% of the subjects displayed short sucking bursts and 45% no bursts at all. Arrhythmic (54% of the cases) or no movements of the tongue (27% of the cases) were observed, resulting in a poor flow rate (in 54% of the subjects) (see Table 5.10).

The difference between bottle- and cup-feeding concerning the tongue is statistically **significant** at a level of 5% in favour of bottle-feeding (p-value:

0.0368) (see Table 5.11). It appears that the tongue is developed to curve and function around a nipple and has difficulty in managing a bolus without it.

## SWALLOWING

*Bottle:* Delayed swallowing was demonstrated in 40% of the subjects. Multiple and incomplete swallows each occurred in 30% of the subjects (see Table 5.10).

*Cup:* Multiple swallows occurred in 64% of the subjects and uncoordinated swallows in 45% of them (see Table 5.10).

Although multiple swallows occurred twice as often during cup- as during bottle-feeding, the mean score of the whole section of swallowing for both the feeding methods did not differ significantly (see Table 5.11). This implies that individual items in the swallowing section will have to be considered when planning appropriate oral feeding intervention.

**In summary, the oral feeding skills of Group 2 during the oral preparatory/oral phase, can be described as follows:**

The **lip** functioning during bottle-feeding was good, with pursing of lips to initiate oral feeding, good closure and maintenance of the closure to limit liquid loss. Fewer problems with rhythm and coordination of lip, jaw and tongue movements, as well as swallowing were demonstrated in this group, than in Group 1 (one week younger). The subjects could, however, not maintain closure with the lips around the cup, which resulted in extensive liquid loss, more than in the younger group. Rhythm and coordination generally did not improve with cup-feeding as with bottle-feeding.

**Jaw** functioning in this group during bottle-feeding can be described as follows: a depression of the jaw to initiate feeding could be executed, it could be

rhythmically moved to suck and these infants had the ability to change the rate of sucking between NNS and NS. During cup-feeding a different picture was observed. These infants could not close the jaw around the cup, minimal excursion inhibited sucking and the rhythm was affected.

The **tongue** formed a central groove, but tented to protrude in the anterior – posterior movement during sucking, especially during cup-feeding. A possible explanation may be that a number of the subjects could now anticipate the feed and the tongue protruded a little to “collect” the milk from the cup. Short sucking bursts were characteristic of this group as well, which correlates with statements of Gryboski (1969) and Bu’Lock (1991), with no improvement in general tongue functioning or swallowing skills from Group 1 (one week younger). Bu’Lock et al. (1990) stated that fewer abnormal tongue movements occur from 35 weeks onwards, but this was not observed in the group used in this study. This group, however, had the subjects with the lowest average birth and current weights and Ballard scores, the second highest incidence of SGA and highest incidence of abnormal tone and apnea. Apart from the fact that they were neuro-behaviourally immature, these infants were expected to be weaker with a lower endurance, which may explain the short sucking bursts and the fact that the swallowing was delayed or multiple swallows performed, due to fatigue.

Multiple **swallows** may have occurred due to the fact that the swallow is ineffective due to the fatigue, or, to protect the airways, extra swallows are performed in attempt to clear the pharynx thoroughly. During cup-feeding swallowing was more uncoordinated, sucking bursts absent and more multiple swallows occurred. A possible explanation may be that sucking facilitates swallowing (Morris & Klein 1987) and sucking in cup-feeding is different because milk can enter the oral cavity by the hand of the feeder and the bolus needs only to be swallowed. The necessary preparation for swallowing may not have taken place. The bolus may also be larger due to the fact that the infant did not have control over the amount of milk entering the oral cavity and multiple swallows may

be used in an attempt to clear the pharynx. If the larger bolus can not be managed by multiple swallows alone, the rest may be expelled to protect the airways, resulting in liquid loss (Comrie & Helm, 1997).

Generally it can be stated that the infants in Group 2 (35 weeks) managed bottle-feeding in the oral preparatory phases **significantly** better than cup-feeding, with the biggest difference in lip performance.

□ **Group 3 (36 weeks gestational age)**

The results are summarized in Table 5.12 and the mean scores, p-values and level of significance are presented in Table 5.13.

**Table 5.12 Problems experienced by Group 3 during the oral/oral preparatory phase**

Score	Group 3 (36 weeks)			
	2		3	
	Bottle	Cup	Bottle	Cup
<b>LIPS/Pursing</b>	0	5	0	1
Closure	0	3	0	2
Maintain	2	2	0	4
Loss of Liquid	0	5	0	3
Movement/Arrhythmic	1	0	1	5
" / Uncoordinated	2	4	1	2
<b>JAW/Depression</b>	2	6	1	1
" / movement / Arrhythmic	1	3	1	3
" / " / minimal / absent	2	5	0	3
" / " / Lack rate change	1	3	1	3
<b>TONGUE / movement / protrusion</b>	0	1	1	0
" / " / elevated / retracted	2	1	0	1
" / " / arrhythmic / weak	2	4	1	3
Sucking bursts	7	5	1	3
Flow rate	3	4	0	2
Bolus formation	1	2	0	2
<b>SWALLOWING/uncoordinated/absent</b>	4	6	0	1
" / delayed /absent	1	3	0	0
" / multiple / no	2	4	0	0
<b>TOTAL</b>	33	66	8	39
<b>2+3</b>	41	105		



Few problems were experienced during bottle-feeding, except for the sucking bursts which tended to be prolonged rather than short in this age group. Cup-feeding caused generally more problems over all the items.

The results are discussed according to the information and structure of Table 5.12.

## LIPS

*Bottle:* Few problems were demonstrated. Only problems with maintaining of lip closure and incoordination of lip movements were observed in 20% of the subjects in each of the items (see Table 5.12).

*Cup:* More problems occurred during cup-feeding. Moderate loss of liquid was recorded in 50% of the cases and extensive loss in 30% of the cases, thus compromising calorie intake. The subjects also demonstrated excessive lip pursing in 50% of the cases, closure was weak in 30% of the cases and absent in 20%, which explains the high incidence of loss of liquid. No rhythm could be observed in 50% of the subjects and uncoordinated movements in 40% (Table 5.12).

Lip functioning during bottle-feeding is **significantly** (5%) better than during cup-feeding (see Table 5.13). The lips are naturally adapted to purse for and seal of around a nipple to prevent liquid loss, which is anatomically problematic with cup-feeding.

## JAW

*Bottle:* Two subjects out of the group of 11 had difficulties to initiate jaw depression and performed minimal excursion of the jaw. One subject in each of the following items was also recorded, arrhythmic movement, lack of rate change

between NNS and NS, absence of movement (see Table 5.12). Problems with jaw functioning in this age group are minimal.

*Cup*: The infants displayed difficulties to initiate jaw depression in 60% of the cases, the excursion of movements during sucking was minimal in half of the cases and absent in 30% of the cases. Arrhythmic movements and lack of rate change between NNS and NS, and absence of movement was recorded in 30% of each of these items (Table 5.12).

The difference between the jaw movements of cup- and bottle-feeding is **highly significant** (level of 1%), with a p-value of 0.0039 (Table 5.13). Jaw movement is thus much better during bottle-feeding.

**Table 5.13 Comparison between bottle- and cup-feeding in Group 3**

	Group 3 (36 weeks) N= 10					
	BOTTLE		CUP		BOTTLE – CUP	
	Mean	SD	Mean	SD	p-Value	Level of significance
Lips	6.81	1.6	10.8	5.18	0.0283	5%
Jaw	4.82	1.94	8.11	2.369	0.0039	1%
Tongue	8.82	2.272	11.33	3.571	0.0547	None
Swallowing	4.73	1.272	6.33	1.936	0.0313	5%

## TONGUE

*Bottle*: 64% of the subjects experienced problems with sucking bursts - 5 of the 7 subjects demonstrated prolonged bursts whereas 2 of the 7 demonstrated short sucking bursts. This is markedly different from the previous two groups, who mainly had short sucking bursts. The shift to prolonged rather than short may be due to maturation and better coordination of movements and/or it may be due to the fact that this group may have better endurance because they had a higher average current weight, higher Ballard scores and no history of congenital infections, pneumonia or BPD, compared with Group 2. The flow rate was slow in only 27% of the subjects. Difficulties with an elevated tongue tip and arrhythmic

tongue movements were recorded in only 20% of cases in each of the items (see Table 5.12).

*Cup:* Sucking bursts caused the biggest problems in this subsection as well - 50% of the subjects demonstrated a prolonged or short burst and a further 30% no sucking burst at all, with a resulting poor flow rate (40% of cases) and no flow rate in 20% of the cases. The movement of the tongue was either arrhythmic (40% of cases) or absent (30%) (see Table 5.12).

The mean scores for tongue functioning did not differ significantly in this age group (see Table 5.13). Both feeding methods presented difficulties with sucking bursts, which seemed to be generally prolonged rather than short in this group.

## SWALLOWING

*Bottle:* Uncoordinated swallowing occurred in 40% of the subjects, multiple swallows in 20% and delayed swallows in only 10%. A marked improvement in delayed swallows was observed for this group compared to the previous group. It seems that the rhythmic, anterior-posterior movements of the tongue during longer sucking bursts, facilitated timely swallowing. This links up with the opinion of Morris & Klein (1987) that effective sucking facilitates effective swallowing.

*Cup:* Uncoordinated swallowing occurred in 60% of the cases, multiple swallows in 40% and delayed swallows in 30%. No real improvement compared to the previous group was observed. The problems in swallowing correlate with the problems in tongue functioning, which again supports the view of Morris & Klein (1987).

The difference in swallowing skills between bottle- and cup-feeding is **statistically significant** at a 5% level (p-value 0.0313), in favour of bottle-feeding. Bottle-feeding appears to be more facilitative for effective swallowing than cup-feeding.

**In summary the oral feeding skills of Group 3 during the oral preparatory /oral phase can be described as follows:**

Although the rooting reflex was diminished in 80% of the subjects, the **lips** could purse to initiate oral feeding for bottle-feeding very well, but tended to purse excessively for cup-feeding. This implies that the rooting reflex may not influence the ability to initiate bottle-feeding. Morris & Klein (1987) stated that diminished oral reflexes reduce the efficacy of sucking. According to the findings of this study, the rooting reflex may be excluded from this statement. Closure around a nipple to prevent loss of liquid was effective in nipple-feeding, although a few subjects still had difficulty in maintaining this closure for more than 2 minutes. Comrie & Helm (1997) stated that infants rely on sucking pads for support with lip closure. This group, however, had the highest incidence of absent sucking pads (60%), but maintained closure relatively well, with minimal liquid loss. Cup-feeding resulted in weak or absent closure of the lips and moderate to extensive liquid loss was recorded, due to the fact that a seal could not be formed around the cup. The question can be raised of whether sucking pads would have aided lip closure during cup-feeding. If we look at Group 2, the presence or absence of sucking pads does not seem to make a difference, as they were the group with the lowest incidence of absent sucking pads, but had more problems in maintaining a closure. This study, therefore, does not support the above-mentioned statement of Comrie & Helm (1997). The subjects also found it difficult to perform rhythmic and/or coordinated movements with the lips during cup-feeding.

Consistent **jaw** depression to initiate bottle-feeding and normal rhythmic movements to maintain it were evident in this group. Jaw depression was more inconsistent with cup-feeding and minimal to no excursions to maintain the cup-feeding occurred. It may be argued that cup-feeding may be an unnatural method of feeding and that the oral structures are generally less adapted to the form of a cup.

The **tongue** formed a central groove to provide a channel for the bolus to be propelled with rhythmic anterior-posterior movements into the pharynx. During cup-feeding, however, the rhythmic movements were problematic. This may be due to the fact that good lip movements facilitate sucking (Morris & Klein, 1987) and because lip movements were absent and/or arrhythmic, the tongue movements during sucking from a cup were compromised. Inappropriate sucking bursts were still a problem, but shifted more towards prolonged (5-20 sucks per burst) than too short sucking bursts (less than 3 sucks per burst). A possible explanation may be that the shift to prolonged bursts may be due to maturation and better coordination of the tongue movements and/or the fact that the subjects had better endurance, as they had a higher average current weight and Ballard scores and no history of congenital infections. They were thus relatively healthy and strong.

Although **swallowing** was still uncoordinated, there were fewer delayed and multiple swallows for bottle-feeding, while a few more subjects still displaying delayed and multiple swallows during cup-feeding. The improved oral feeding skills demonstrated in this group correlate with the fact that only 54% of them still received mainly nasogastric feeding. Although, according to their good performances with bottle-feeding, this percentage could be higher, the fact that most of the subjects were receiving cup-feeding at the time of the evaluation, which caused more problems, may be the reason why nasogastric feeding was still preferred by the staff.

Group 3 managed bottle-feeding **significantly** better than cup-feeding in the oral preparatory/oral phase, except for tongue functioning, which was similar. So far, this group, as the most mature of the three subject groups, demonstrated the best oral feeding skills.