Position Statement:
Enteral Calcium, Phosphate, Potassium and Zinc Supplementation in Neonates and Children

Take Home Summary

- Enteral calcium, phosphate, potassium and zinc supplements are used in UK paediatric practice.
- There are no licensed oral liquid calcium, phosphate or zinc products available in the UK.
- NPPG would welcome development of the following as licensed products:
  - An oral liquid providing 1mmol/mL of elemental calcium.
  - An oral liquid providing 1mmol/mL of phosphate.
  - An oral liquid providing 5mg/mL of elemental zinc.
- Due to the lack of available oral liquids, administration of part of a licensed effervescent calcium or phosphate tablet, by dissolving a whole tablet in a known volume and taking the required portion is common. This off-label practice is challenging and error prone.
- For patients under 10kg, it may also be necessary to administer zinc using the same method. For larger patients, the licensed dosing uses half or whole tablets. If a half tablet is to be given, it should be halved prior to dissolving in water.
- A licensed 1mmol/mL potassium oral liquid product is now available in the UK, meaning that the need to use part of an effervescent potassium tablet is rare, but this may be required if the liquid is unavailable/unsuitable.
- The visual appearance of effervescent tablets and their packaging can be similar, particularly in the case of Sando K® and Phosphate Sandoz®. This not infrequently leads to dispensing or administration errors, and extra vigilance is required, especially in patients using multiple effervescent tablet products.
- Where effervescent tablets are dissolved in water and an aliquot used to give the required dose:
  - Follow the recommendations in Tables 1, 2 , 3 and 4.
  - There will be some dosing inaccuracy and variability which cannot be eliminated or easily quantified. Close monitoring of patient response and appropriate dose adjustment is necessary.
  - Doses should be rounded to enable measurement. Suggested approaches are provided in Tables 5 and 6.
  - Any liquid remaining after the dose should be discarded; a new tablet should be used for each dose.
- When dispensing effervescent tablet products and only a portion is needed to administer the required dose, Hospital and Community Pharmacy staff should ensure that:
  - Clear instructions are provided on the dispensing label, supported wherever possible by direct education of patients/carers.
  - Appropriate equipment is provided. This can be tailored to patient/carer needs and local practice, but the following is suggested:
    1. A 20mL oral/enteral syringe to measure the initial volume of water required to disperse the tablet.
    2. A reusable, plastic medicine pot in which the tablet can be dispersed in water.
    3. A smaller oral/enteral syringe for measurement and administration of the required dose. For dose volumes of less than 1mL, a 1mL syringe is required.
- Effervescent tablets often contain significant amounts of sodium as an excipient. This should be considered when selecting the most appropriate product for an individual patient or cohort of patients.
- Unlicensed phosphate oral solutions are available in the United Kingdom and may allow for safer supplementation in some patient groups, particularly in the neonatal setting. The risks inherent to using an unlicensed product in preference to off-label use of a licensed product should be considered when determining the right approach for an individual patient or cohort of patients.

Additional Resources

Additional resources are available to support the implementation of recommendations above:

- Specialist Pharmacy Service – Medication safety - Managing the risks of using effervescent tablets in children.
- Medicines for Children. Information for parents and carers: How to give calcium, phosphate or potassium from effervescent tablets – Medicines For Children .

Table 1: Calcium Supplementation

Product	Manufacturer	Calcium Content per Tablet	Instructions for the Administration of "Part Tablet Doses"	Additional Information[1,2,3]
Calcium 500mg Effervescent Tablets	Accord-UK Ltd (SmPC)	12.5mmol	1. Dissolve each 12.5mmol tablet in 12mL water *(each tablet displaces approximately 0.5mL of water and so the final concentration obtained will be approximately 1mmol/ mL)*. 2. Once the tablet has fully dispersed and fizzing has stopped, which is usually after about 5 minutes, use the necessary volume of 1mmol/mL solution to administer the required dose. 3. Discard the remaining solution.	Equivalent product formerly marketed as Cacit® 500mg Effervescent Tablets. Each tablet also contains 0.87mmol of sodium, meaning that for each mmol of calcium administered the patient will also receive 0.07mmol of sodium. Also contains sunset yellow (E110) as an excipient.
Calvive® 1000 Effervescent Tablets	GlaxoSmithKline Consumer Healthcare (SmPC)	25mmol	1. Dissolve each 25mmol tablet in 20mL water *(each tablet displaces approximately 5mL of water and so the final concentration obtained will be approximately 1mmol/mL)*. 2. Once the tablet has fully dispersed and fizzing has stopped, which is usually after about 5 minutes, use the necessary volume of 1mmol/mL solution to administer the required dose. 3. Discard the remaining solution.	Equivalent product formerly marketed as Sandocal 1000® Tablets. Each tablet also contains 5.95mmol of sodium, meaning that for each mmol of calcium administered the patient will also receive 0.24mmol of sodium.
Effervescent Calcium Gluconate Tablets BP 1g	Accord-UK Ltd (SmPC)	2.23mmol	1. Dissolve each 2.23mmol tablet in 20mL water *(each tablet displaces approximately 0.5mL of water and so the final concentration obtained will be approximately 0.1mmol/mL)*. 2. Once the tablet has fully dispersed and fizzing has stopped, which is usually after about 5 minutes, use the necessary volume of 0.1mmol/ mL solution to administer the required dose. 3. Discard the remaining solution.	Each tablet also contains 4.5mmol of sodium, meaning that for each mmol of calcium administered the patient will also receive 2mmol of sodium. *(Calculations based on rounded value of 2.2mmol calcium per tablet for ease of measurement)*.

Table 2: Phosphate Supplementation

Product	Manufacturer	Phosphate Content per Tablet	Instructions for the Administration of "Part Tablet Doses"	Additional Information[4]
Phosphate Sandoz® ***Note: risk of confusion with Sando K®***	Alturix Limited (SmPC)	16.1mmol	1. Dissolve each 16mmol tablet in 15mL water *(each tablet displaces approximately 1mL of water and so the final concentration obtained will be approximately 1mmol in 1mL)*. 2. Once the tablet has fully dispersed and fizzing has stopped, which is usually after about 5 minutes, use the necessary volume of 1mmol/mL solution to administer the required dose. 3. Discard the remaining solution.	Each tablet also contains 20.4mmol of sodium and 3mmol of potassium, meaning that for each mmol of phosphate administered the patient will also receive 1.27mmol of sodium and 0.19mmol of potassium. *(Calculation based on rounded value of 16mmol phosphate per tablet for ease of measurement)*.

Table 3: Potassium Supplementation

Product[5]	Manufacturer	Potassium Content per Tablet	Instructions for the Administration of "Part Tablet Doses"
Sando K® ***Note: risk of confusion with Phosphate Sandoz®***	Alturix Limited (SmPC)	12mmol	1. Dissolve each 12mmol tablet in 11mL water *(each tablet displaces approximately 1mL of water and so the final concentration obtained will be approximately 1mmol in 1mL).* 2. Once the tablet has fully dispersed and fizzing has stopped, which is usually after about 5 minutes, use the necessary volume of 1mmol/mL solution to administer the required dose. 3. Discard the remaining solution.

Table 4: Zinc Supplementation

Product[6]	Manufacturer	Zinc Content per Tablet	Instructions for the Administration of "Part Tablet Doses"
Solvazinc 45mg Effervescent Tablets®	Galen Limited (SmPC)	45mg (elemental zinc)	1. Dissolve each 45mg tablet in 8.5mL water *(each tablet displaces approximately 0.5mL of water and so the final concentration obtained will be approximately 5mg in 1mL).* 2. Once the tablet has fully dispersed and fizzing has stopped, which is usually after about 5 minutes, use the necessary volume of 5mg/mL solution to administer the required dose. 3. Discard the remaining solution.

Supporting Information

Enteral calcium, phosphate, potassium and zinc supplementation is used in paediatric and neonatal care, either short-term to treat acute deficiency, or longer term e.g. to treat Osteopenia of Prematurity or Fanconi syndrome

No licensed oral liquid calcium, phosphate or zinc products are available in the UK, which is not ideal, especially for administering smaller doses to neonates and infants. Instead, caregivers must administer a portion of an effervescent tablet, a practice which is off-label and error prone. In the case of calcium, the risks are further exacerbated by the available effervescent tablet preparations all containing differing amounts of calcium, variably expressed in terms of mass units (e.g. g, mg) or mmol, and/or in terms of calcium salt or elemental calcium.

Dosing Accuracy when Administering a Dose by Taking a Portion of a Dissolved Effervescent Tablet

Effervescent tablets can displace significant volumes of water on dissolution, creating complexity if only part of the final solution is used to administer a dose. Displacement values are not published in the relevant Summaries of Product Characteristics (SmPCs)[1-6], and direct communication with the respective manufacturers revealed that they do not hold this information on file[7-12]. Water is displaced directly by tablet components and by gas generated during effervescence, and so displacement is likely to be dynamic as much of the dissolved gas will eventually come out of solution and disperse into the surrounding air.

Failure to consider displacement will lead to dosing inaccuracy. However, uncertainty around the extent of displacement means that making definitive recommendations is difficult. The instructions provided in Tables 1-4 take displacement into account based on pragmatic experience in UK paediatric centres. There will be some variation in final volumes obtained when following these recommendations, but any resultant dose inaccuracy is likely to be clinically insignificant; using a consistent preparation method will itself minimise variation. Nonetheless, close monitoring of patient response and appropriate dose adjustment is required. An two-stage approach of dispersing a tablet in a small amount of water before further diluting to a final volume once effervescence is complete may increase accuracy, but is likely to be more error prone and/or impractical for busy caregivers.

It is recognised that the suggested dilution information in Tables 1-4 may result in dose volumes which may be excessive for some patients, particularly for larger doses. If it is necessary to deviate from the standard dilutions, the displacement values provided should still be used to enable accurate dosing.

Prescribers should round calculated calcium, phosphate, potassium and zinc doses, to aid accurate administration. Suggested approaches using 1mmol in 1mL and 5mg/mL solutions are given in Table 5 and Table 6 respectively.

Table 5: Suggested Rounding using 1mmol/mL solution

Calculated Dose	Round to the Nearest
0.2-0.49mmol	0.02mmol
0.5-1.9mmol	0.1mmol
2 - 4.9mmol	0.2mmol
5 - 9.9mmol	0.5mmol
More than 10mmol	1mmol

Table 6: Suggested Rounding using 5mg/mL solution

Calculated Dose	Round to the Nearest
0.5-1.9mg	0.1mg
2 - 4.9mg	0.2mg
5 - 9.9mg	0.5mg
More than 10mg	1mg
-	-

Giving the same daily dose in fewer instalments may be appropriate if this aids accurate dose measurement.

Excipient Challenges with Effervescent Tablets

The sodium content of some calcium and phosphate effervescent tablets is significant and should be taken into account when selecting the most appropriate product for an individual patient or cohort of patients.

There are anecdotal reports of alkalosis when effervescent calcium tablets have been used in neonates. This is likely to be due to incomplete consumption of carbonate if the effervescence process has not been allowed to run its full course. Use of an alternative formulation may be justified if the problem persists.

Equipment Required to Administer Doses which are a Portion of an Effervescent Tablet

A combination of equipment is required to accurately measure and administer doses which are a portion of an effervescent tablet; this should be issued at the point of dispensing. The equipment provided can be flexible according to patient/carer needs, but the following is suggested:

- A 20mL syringe oral/enteral syringe to measure the initial volume of water required to dissolve the tablet. The volumes of water specified in Tables 1-4 have been rounded to allow use of a 20mL syringe.
- An open container such as a reusable plastic medicine pot for dissolution of the tablet.
- A second, oral/enteral syringe to draw up and administer the required dose. This syringe should be of appropriate size and have appropriate graduations to measure the required dose:
  - Where the dose volume is less than 1mL, a 1mL syringe should be used to minimise dosing inaccuracy. Use of larger syringes to measure these small volumes results in a greater degree of inaccuracy and variability, even if the required volume corresponds with the available graduations[11].
  - For dose volumes of 1mL or greater, it is not possible to make specific recommendations as the graduations on oral/enteral syringes are not standardised. The most appropriate device should be selected by the dispensing pharmacist.

Oral Liquid Alternatives

NPPG would welcome development of licensed oral calcium, phosphate potassium and zinc liquids, the ideal products would provide 1mmol/mL of elemental calcium, phosphate or potassium, or 5mg/mL zinc. It is recognised that that these concentrations may be challenging to formulate.

References:

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4. Summary of Product Characteristics – Phosphate Sandoz. Alturix Limited. Accessed on 21/03/2025 [date of revision of text 15/11/2023].
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Disclaimer

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Key changes from Version 3 (published March 2025):

- Wording updated to reflect the fact that a new licensed oral potassium liquid is available in the UK.

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