

# Toxicity

## Precautions & Contraindications



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BY TRACY DOOLE

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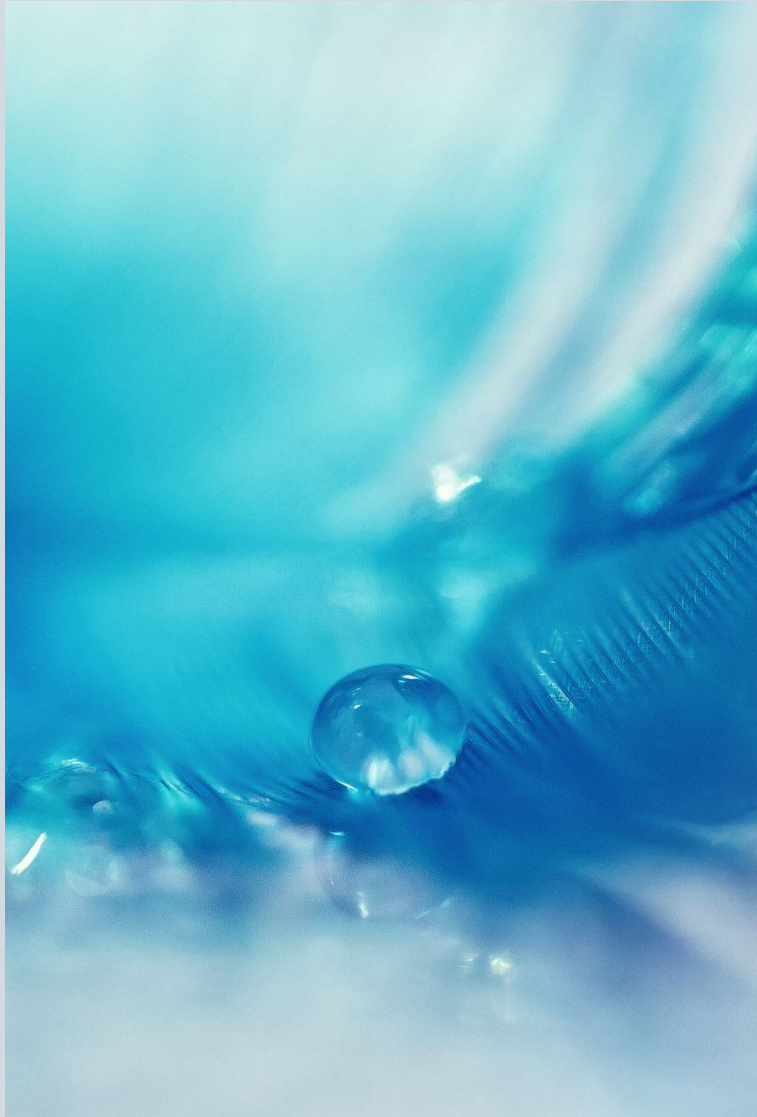
# WHO statement

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It is estimated that caries of the permanent teeth is the most prevalent of all conditions assessed, with **2.4 billion** people globally suffering from **caries of permanent teeth** and **486 million children from caries of primary teeth**

Public health actions are needed to provide sufficient fluoride intake in areas where this is lacking, so as to minimize tooth decay.

This can be done through drinking-water fluoridation or, when this is not possible, through salt or milk fluoridation or use of dental care products containing fluoride, and by advocating a low-sugar diet



# How Safe is Safe?

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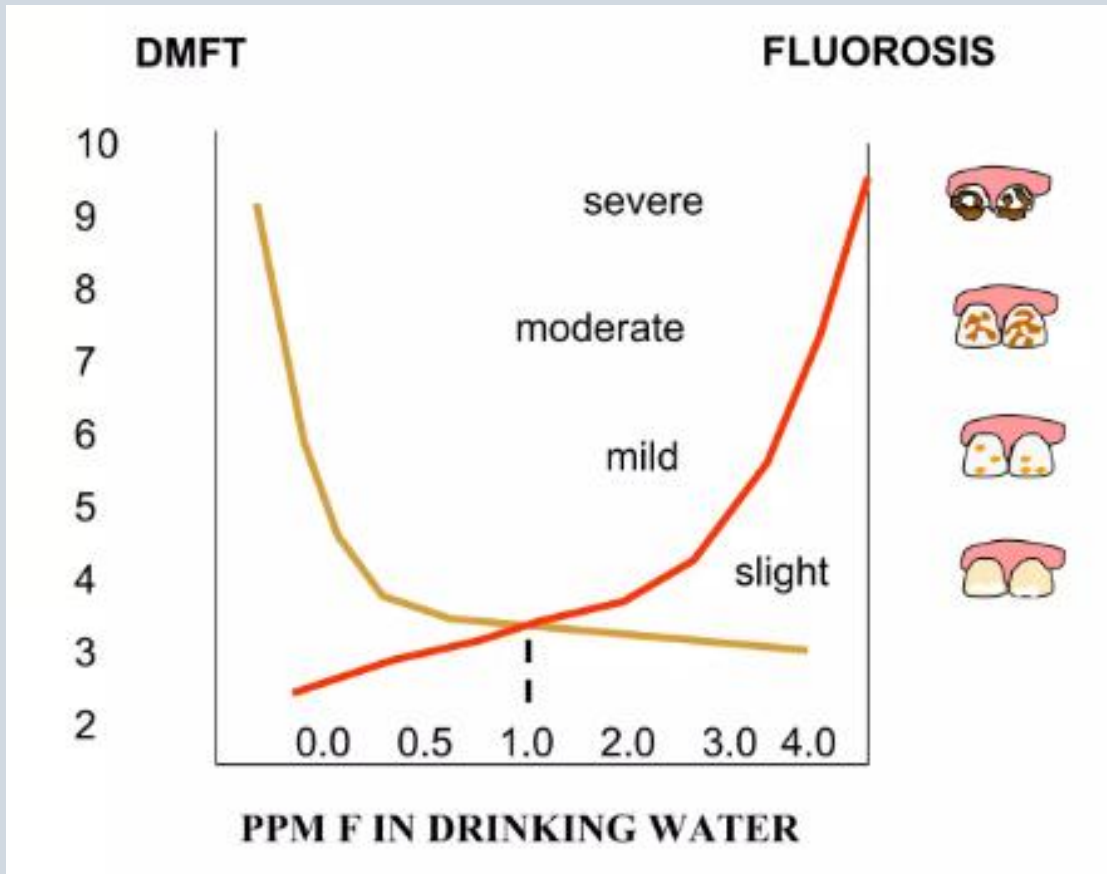
**Fluoride intake has both beneficial & negative effects:**

- in reducing the incidence of dental caries
- in causing tooth enamel and skeletal fluorosis following prolonged high exposure.

The ranges of intakes producing these opposing effects are not far apart

***WHO 1963 recommended optimal level of fluoride in drinking water as 0.5 to 1.0 PPM***

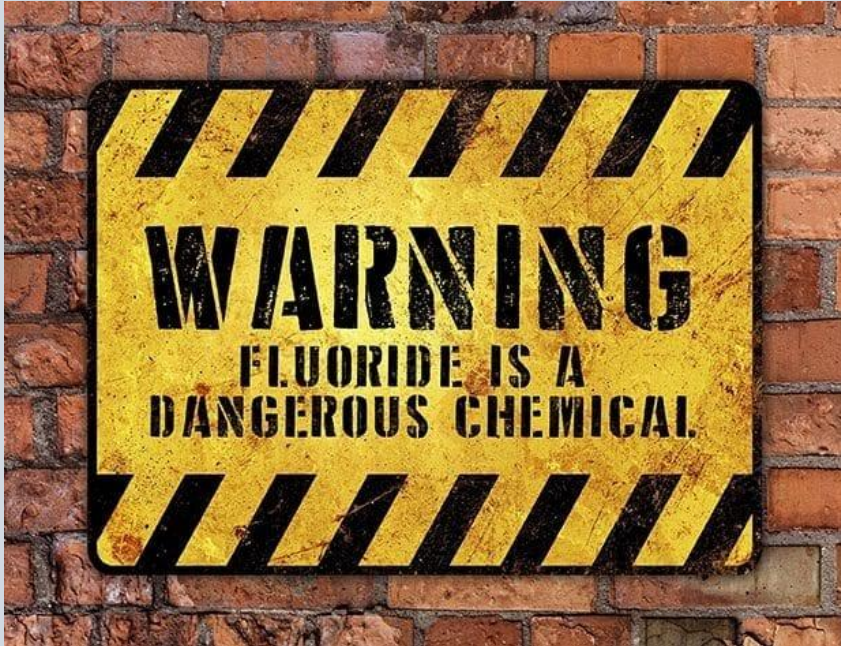
# How Safe is Safe?



***WHO 1963 recommended optimal level of fluoride in drinking water as 0.5 to 1.0 PPM***

# Background to Fluoride Toxicity

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Excess ingestion of fluoride can lead to dental fluorosis and skeletal fluorosis

1ppm fluoride (Parts per million)

1mg of fluoride per litre



# Fluoride toxicity

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**Acute toxicity:** excessive ingestion of fluoride over short period of time produces acute toxicity (Rapid onset minutes to hours)

**Chronic toxicity:** excessive ingestion of fluoride over long period of time produces chronic toxicity



# Fluoride toxicity

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**Acute toxicity**



**the speed and severity of the response are dependent on the amount of fluoride ingested weight and age of the individual**

# Signs & Symptoms

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## ACUTE TOXICITY

- Nausea and vomiting
- Abdominal pain and diarrhea
- Excessive salivation
- Headache and weakness
- Severe cases:
  - Low blood calcium (hypocalcemia)
  - Muscle spasms
  - Heart rhythm disturbances
  - Seizures or death (rare)

## CHRONIC TOXICITY

Dental fluorosis

- White streaks, brown stains on teeth
- Enamel pitting in severe cases

Skeletal fluorosis

- Bone pain and stiffness
- Joint immobility
- Increased fracture risk

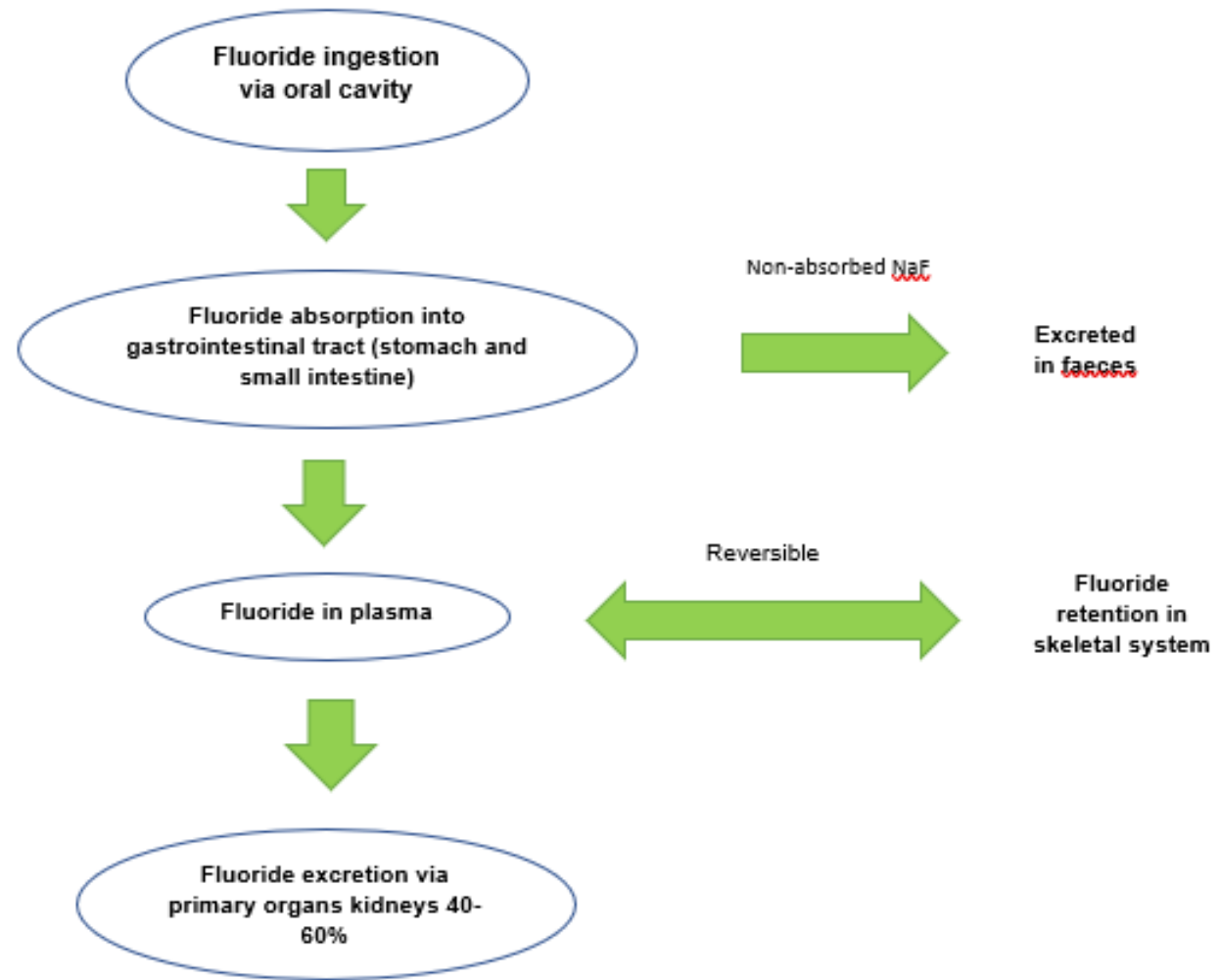
# Effects of Fluoride Toxicity

## Acute Effects

Nausea, vomiting  
Hypocalcemia  
Tetany especially of hand and feet  
Hypotension, hypersalivation  
Mixed metabolic and respiratory acidosis  
due to failure of renal/respiratory system  
Coma and convulsions leading to death

## Chronic Effects

Dental fluorosis  
Skeletal fluorosis  
Hypersensitivity reactions  
Dyspepsia, gastric irritation  
Insufficiency of renal system  
Numbness, muscular spasm  
Birth defects and cancer



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# 44 Insane Patients Killed By Poisoning

## Ate Scrambled Eggs Secured From Federal Surplus Commodities Corporation

Salem, Ore., Nov. 19 (AP)—Forty-four insane inmates of the Oregon State Hospital have died from an unidentified poison—possibly contained in frozen eggs—and a corps of physicians struggled today to save the lives of more than 400 other men and women.

The poison struck swiftly. Within 15 minutes after dinner last night, at which the eggs were served scrambled, the victims began complaining of violent cramps. The first death occurred within an hour. By 10 p. m., five hours after

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# Oregan 1942

In 1942 Mass poisoning at Oregan hospital with fluoride NaF was mistaken for powdered milk

Approx 17 pounds of NaF was added to 10 gallons of egg

There were 263 cases of acute poisoning and 47 fatalities

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## Milk fluoridation

There are a few community schemes in England which supply children with fluoridated milk at early years and school settings. They are provided in areas that are not fluoridated and where levels of dental caries are high. In 2016 an evidence review and guide for local authorities commissioning programmes such as fluoridated milk classified these as of limited value for oral health<sup>[footnote 4]</sup>.



# Alaska, 1992

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150ppm F was present in the water due to miscalculations

Almost 300 people had nausea, vomiting, abdominal pain, diarrhoea, pain and **one** death occurred

# What does this mean for applying fluoride varnish?

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Lots of the information relates to water fluoridation

Patients attending may be getting fluoride from other sources and may have questions relating to this

Important to understand other sources of fluoride intake patient may be getting

# In simple terms

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# Is Fluoride Varnish Toxic For A Child?

Levels of fluoride within the body that prove to be toxic and lead to harmful effects in a person, these levels are based upon weight and apply to both children and adults.

The ***accepted toxic level is 5 mg/kg of weight for a person*** which can lead to side effects such as nausea, vomiting, hypotension, renal and respiratory complications, and coma in its acute form

Lesser toxic levels can lead to more chronic side effects such as dental and skeletal fluorosis and gastric concerns

N.B These symptoms usually appear within an hour of ingestion so may not manifest until sometime after the patient has left the surgery.

(Ullah, R et al 2017)

# Is Fluoride Varnish Toxic For A Child?



Example: If your child weighs approximately 13 kg or 2 stone, they would need to ingest over 65 mg of fluoride to show signs of toxicity



It should be stated that while this does mean that there is in fact a toxic level of fluoride, keep in mind that there are toxic levels of several things that we as humans consume and come in constant contact with on a daily basis



**(Ullah, R et al 2017)**

# Is Fluoride Varnish Toxic For A Child?

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Anyone recommending the use of fluoride containing dental preparations should be aware of the fluoride content and the potential health hazards

All evidence on the toxicity of fluoride in humans is gathered from recorded cases of deliberate or accidental overdose!

**THE ACUTE LETHAL DOSE IS APPROXIMATELY 15MG/KG OF BODY WEIGHT, ALTHOUGH A DOSE AS LITTLE AS 5MG/KG OF BODY WEIGHT MAY KILL SOME CHILDREN.**

**A DOSE OF 5MG/KG SHOULD TRIGGER IMMEDIATE EMERGENCY TREATMENT. AS LITTLE AS 1MG/KG OF BODY WEIGHT CAN PRODUCE SUB-LETHAL TOXIC EFFECTS**

# Fluoride toothpaste toxicity

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## Example:

Children under 3 years old using a smear of toothpaste

Toothpaste 1'000ppm = 0.1mg Fluoride

Overall absorbable dose of only 0.007-0.01mg per KG if swallowed by a child weighting 15KG

# What to do if high levels are ingested

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A small quantity of fluoride, less than 5mg/kg body weight, is neutralised by drinking a large volume of milk.

However, if there has been more than this ingested, or there is some doubt about the exact quantity consumed, the child should be taken immediately to hospital and given gastric lavage.

***Speed is of the utmost importance because fluoride is absorbed very rapidly***

## **Precautions**

Fluoride varnish should therefore be used with extreme care and only used in exceptional cases with pre-school children

Although no cases of acute toxicity due to ingestion of fluoride toothpaste have been reported so far

A 5 year old could be severely poisoned by consuming about two thirds of a 100ml tube of 1500ppm toothpaste, and a 1 year old would need to consume only half this amount.

Fluoride toothpaste and mouthwashes should always be kept out of the reach of small children

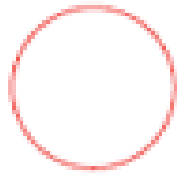
## Duraphat® Varnish



Up to 0.25ml.  
for primary teeth



Up to 0.40ml.  
for mixed dentition



Up to 0.75ml.  
for permanent dentition



# Colgate Duraphat

At present Colgate® Duraphat® Varnish 50mg/ml Dental Suspension 2.26% (22,600ppm) Sodium Fluoride (Duraphat Varnish) is the only product licensed specifically for caries prevention



# Clinical trials on Duraphat

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The first clinical trial to see the efficacy of Duraphat was carried out by **Heuser and Schmidt in 1968**. One application of Duraphat was done on 224, 11-14 year old children & showed a 30% reduction DMFT after a period of 15 months

Majority of clinical trials were in the 1970s

Efficacy reported 10-45% DMFT reduction after 23 months (**Maiwald and Geiger 1973**)



# Precautions relating to fluoride varnish

## The evidence based guidance for fluoride varnish states:

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- All children aged three years and above should have fluoride varnish applied twice yearly (2.26% NaF)
- Those children giving concern should receive two or more applications per year

## As a precaution

Parents should be asked to let the dental practice know if fluoride varnish has recently been applied at nursery or school

This allows the dental practice to space out your child's fluoride varnish applications to ensure maximum benefit & reduce risk of toxicity from overuse

# Contraindications

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DO NOT USE IF:

- Allergy to sodium fluoride, colophony or other ingredients
- Patient has mouth ulcers or gum disease (active)
- Patient has ulcerative colitis
- Patient has stomatitis (inflammation of the mouth)
- Patient has asthma
- Latex allergy



# Contraindications

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Not recommended for use on individuals with a history of allergies – to the colophony component.

In patients with ulcerative colitis and stomatitis burning sensation is a side effect when comes into contact with the gingival tissue and also causes discolouration of the teeth.



# Children with Asthma

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**Delivering Better Oral Health includes the following statement:**

*“The use of Duraphat is contraindicated in patients with ulcerative gingivitis and stomatitis. There is a very small risk of allergy to one component of Duraphat (colophony), so for children who have a history of allergic episodes requiring hospital admission, including asthma, varnish application is contraindicated. Other brands of varnish may have different constituents”*

*Prescribing Dentist/Clinicians should use their clinical judgement when deciding to use fluoride varnish.*

# References

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[Chapter 2: Summary guidance tables for dental teams - GOV.UK \(www.gov.uk\)](#)

[Delivering better oral health toolkit:Chapter 9: Fluoride - GOV.UK \(www.gov.uk\)](#)

Ullah, R., Zafar, M.S. and Shahani, N., 2017. Potential fluoride toxicity from oral medicaments: A review. *Iranian journal of basic medical sciences*, 20(8), p.841.

WHO

Preventive dental advice, care and treatment for children from 0-3 years Welsh Government: [preventive-dental-advice-care-and-treatment-for-children-from-0-3-years.pdf \(gov.wales\)](#)

# References

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Colgate Duraphat Varnish information available: [www.colgateprofessional.co.uk/products/Colgate-Duraphat-Varnish-50mgml-Dental-Suspension/details](http://www.colgateprofessional.co.uk/products/Colgate-Duraphat-Varnish-50mgml-Dental-Suspension/details)  
(<http://www.colgateprofessional.co.uk/products/Colgate-Duraphat-Varnish-50mgml-Dental-Suspension/details>)

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(<http://www.gdcuk.org>)