Self applied fluorides:

Self application of fluoride is usually carried out with groups of persons, usually children at one time, under only general supervision, in contrast to professionally applied fluoride treatments which are expensive because they depend upon one professionally trained person treating one person at a time, with expensive equipment or supplies.

*Requisites for self applied fluoride agents:* (community and individuals):

1. Should be completely safe.
2. Should be effective for preventing caries.
3. Method should be suitable for use by large groups and at a reasonably low cost.
4. Should be acceptable to participants.
5. Should be easy to use to ensure compliance.
6. Should require few professional personnel.
7. Should be able to be supervised by non-dental personnel after short periods of in-service training.

The concentration of fluoride in dentifrices, mouth rinses, and gels for home use in USA is regulated by the Food and Drug Administration. For dentifrices, the agency has proposed a range of concentrations from 850 to 1150 ppm total fluoride. Since, the availability of fluoride ion in concentrations that are safe and effective is the most important consideration, the minimal fluoride ion concentrations that must be available in dentifrices, depending on the active ingredient.

**Fluoride dentifrices**

Investigation into effectiveness of adding fluoride to toothpaste has been carried out since 1945 and covers a wide range of active ingredients in various abrasive formulations. Fluoride compounds that have been tested for caries-inhibitory
properties include sodium fluoride, acidulated phosphate fluoride, stannous fluoride, sodium monofluorophosphate and amine fluoride. Most toothpaste nowadays contain sodium fluoride or sodium monofluorophosphate as active ingredient, usually in concentration of 1000-1500 mg F/g.

**Fluoride Concentration in Toothpaste**

Studies have been undertaken to investigate the dose response relationship for different fluoride levels in toothpaste up to 2500 ppm. The results suggest that increased fluoride level give a greater reduction in the incidence of dental caries. Increased benefit is of the order of 6 percent for each 50 over 1000 ppm fluoride. In Europe an upper limit of 1500 is suggested for toothpaste sold over the counter without prescription. In children 500-550mg F/g.

**Mechanism of Action**

Two possible mechanisms have been suggested. One suggests that MFP ions is incorporated into the hydroxyapatite crystal lattice with a subsequent slower release of fluoride ion which then replaces hydroxyl groups to form fluorapatite. On the other hand it is suggested that it is MFP ions itself which is incorporated into the apatite crystals by means of a substitution reaction with one or more of the phosphate groups.

Fluoride in toothpaste is taken up directly by demineralized enamel and it also increases the fluoride concentration in dental plaque, thus leaving a store of fluoride available for remineralization when pH drops.

**Fluoride mouthrinses**

Frequent use of low concentration of fluoride is more cariostatic than less frequent use of higher concentration of fluoride for topical application. In areas where water fluoridation is not possible or has not been implemented, the fluoride mouthrinses have been found to be an effective tool in prevention of dental caries. Over the past few decades fluoride mouthrinsing has become one of the most widely used caries-preventive public health measure.

Sodium fluoride mouth rinse is now widely used in school based programs as well as by individuals at home. Other less extensively tested fluoride mouth rinses include those containing APF, stannous fluoride, ammonium fluoride and amine fluoride. For reasons of lowest expense, convenience in handling as well avoidance
of unpleasant taste, NaF became the most widely used of these tested products in public health programs.

Mouth rinse products contain fluoride ion at a concentration of 200-900 mg/L for daily and weekly use respectively

Recommendations:
Mouth rinses designed to be rinsed and spit out.

0.2 percent of NaF solutions are recommended (900 ppm PI for weekly fortnightly use, while 0.05 percent (1225 ppm F) for daily use. In communities with fluoridated water supplies or with natural occurring optimum fluoride level in drinking water, mouth rinsing programs would give a super added benefit.

Fluoride exposure from multiple sources
Fluorides are found naturally throughout the world. They are present to some extent in all foods and waters so that all humans ingest some fluoride. Fluoride has become more available food and drink. fluoridated water, dentifrices, mouthwashes, etc can be extremely beneficial in terms of the prevention of dental decay. It can also increase the risk of the milder forms of dental opacities fluorosis. Because of this there should be a coordinated approach to fluoride delivery. It is imperative that fluoride availability from all sources is taken into account before embarking on a specific course of fluoride treatment. The reduction may reach 75%.

Fluoride Toxicity
Toxicity is due to excessive ingestion of fluoride and can be acute or chronic.

Acute toxicity is due to ingestion of large dose of fluoride in a short period of time while chronic toxicity is due to ingestion of excess fluoride in low doses over a prolonged period of time.

- Safely tolerated dose (STD)is 8-16 mg/kg body weight.
- Certainly Lethal dose of fluoride (CLD) is 32-64 mg/kg body weight.
- For children under 6 years of age, however, 500 mg would be lethal
Factors influencing acute toxicity

1- Form of administration: Fluoride administered in liquid form is absorbed quickly, hence the symptoms of toxicity is rapidly seen.

2- Age: Younger the age more severe and faster are the symptoms of toxicity.

3- Rate of absorption: Rate of absorption depends on many factors

Signs and symptoms of acute fluoride toxicity

• Nausea, vomiting, abdominal pain, increased salivation, nasal discharge
• Generalized weakness, muscle spasm
• Reduced plasma calcium level, increased plasma potassium level
• Weak thready pulse, fall in blood pressure
• Depression of respiratory center
• Cardiac arrhythmia
• Coma and death.

Management of acute toxicity

Immediate management should be aimed at:

• Reducing the fluoride absorption by inducing vomiting through emetics
• Increasing fluoride excretion by increasing the alkalinity of the urine and fluid replacement
• Plasma calcium and potassium level monitoring

Management based on the amount of fluoride ions ingested

• Management based on the amount of fluoride ions ingested
  •  < 5.0 mg/kg Milk Induce vomiting
  •  >5.0 mg/kg Induce vomiting
  •  > 15.0 mg/kg Induce vomiting
  Milk, 5% calcium gluconate, Hospitalization
Cardiac monitoring - peaking of T wave and prolonged QT interval in a ECG
Slow administration of 10 ml of 10% calcium gluconate
Maintain adequate urine output
Supportive measures for shock

Calculating Toxic Dose

To convert the percentage of fluoride ion to fluoride mg/gm, multiply the percentage of fluoride ions with 10

\[ 0.9 \times 10 = 9 \, \text{mg of fluoride ions in one gram of sodium fluoride} \]

- To calculate the amount of fluoride ions swallowed, multiply the fluoride in mg/gm with the total amount of agent swallowed.

\[ 9 \, \text{mg/gm} \times \text{total amount of sodium fluoride swallowed} = \text{total amount of fluoride ions swallowed} \]

- Total amount of fluoride ions swallowed/weight of the child in kg.

Chronic Toxicity

It is caused due to ingestion of excess amount of fluoride over a prolonged period of time. It can cause dental and skeletal changes referred to as dental and skeletal fluorosis respectively.