



NOS Toxicity

Heavy NOS use causes nerve damage and can lead to permanent disability

N_2O , NOS, nangs or laughing gas is often used recreationally and occasional use appears to be of low risk for most people. However, NOS is *addictive* and people can develop heavy use (inhaling numerous times daily) for which there are *harmful* and potentially *permanent* consequences.

Nitrous oxide *turns off* vitamin B12 leading to a range of physical (particularly neurological) and psychiatric problems. The inactivation of vitamin B12 creates a 'functional B12 deficiency' which, among other things, degrades the *myelin* coating around nerves in the brain and body. This leads to problems with nerve transmission and neurological function. Clients with *pre-existing vit B12 deficiency* (e.g. vegan diet, coeliac's disease) are likely to be at greater risk.

Symptoms can include *sensation loss* and *muscle weakness*, which usually starts in the peripheries (i.e. fingers and toes / hands and feet) but then spreads. Clumsiness and walking difficulties can occur. Involvement of the optic nerve can cause *vision* loss. *Psychiatric symptoms* (such as memory loss, delusions, hallucinations, anxiety, depression) sometimes occur. People can also present with unusual signs and symptoms, that are clinically confusing.

A permanent condition called *nitrous-oxide induced subacute combined degeneration of the spinal cord* can occur if a client has very low vit B12 levels for a long time and isn't treated. This is essentially a kind of paralysis combined with loss of sensation in the limbs. To summarise, heavy, sustained NOS use puts the user at risk of *permanent physical disability* (i.e. requiring a wheelchair to mobilise).

Management of nitrous-oxide induced neurological problems

1. Psychoeducation and counselling support to *stop* and *abstain* from NOS.
2. Medical assessment, neurological examination and investigations (an MRI may be required). Referral to a neurologist for further advice/input should be considered.
3. Testing the blood for vitamin B12 levels is seldom helpful as serum vitamin B12 levels are often within the normal range - NOS inactivates B12 but doesn't get rid of it. There are other more specialised tests that can be tried (homocysteine and MMA levels are elevated in >98% of patients with clinical deficiency), however its best to discuss these with a neurologist.
4. Vit B12 supplementation.
 - a. There should be a low threshold for providing intramuscular B12 replacement (a minimal risk intervention) if there are concerns, including prior to any blood tests and even if B12 levels are normal.
 - b. Recommended is *2 weeks of alternate day 1 mg B12 injections* (hydroxocobalamin).
 - c. These can be continued if there are on-going neurological problems
5. Please note that vitamin B12 injections will be *ineffective* if the client continues to use NOS, as nitrous oxide *inactivates* vitamin B12) The client needs to be advised of this clearly so there is no misunderstanding. People sometimes think that B12 supplementation means they can continue to use.

Please see <https://www1.racgp.org.au/ajgp/2021/november/recreational-nitrous-oxide-neurotoxicity> for Australian Guidance on this topic.