# Do specific dental problems predispose to cardiac arrhythmias and sudden death on the sports field?

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Sudden deaths on the sports field due to cardiac dysrhythmia are uncommon but have far-reaching effects. Famous star players, such as Marc Vivien-Foe (28) have died as a result of it in recent years. Vivien-Foe of Manchester City suffered death from **cardiac arrest** during an international match for his country Cameroon. The English professional football player Fabrice Muamba of Bolton Wanderers also collapsed during a FA cup match against Tottenham Hotspur (2012). He also suffered **cardiac arrest**. After a 72 minute (!) revival Muamba was taken to hospital in a critical condition and his story became what was possibly the most discussed case of **cardiac arrest** ever. It certainly ended with a miracle. Muamba will never be able to play at the professional level again but at least he survived. The most amazing thing is that Muamba did not acquire any lasting brain damage. Medical doctors were unable to find any cardiac muscle abnormalities. Why his heart suddenly stopped working during the match in North London remains a mystery.

Throughout Holland it was a big shock when young Ajax football player Abdelhak Nouri (20) collapsed during a friendly match in Austria against Werder Bremen (2017). He was revived on the field while his teammates were watching, taken aback on the sideline. A few days later, Ajax reported that Nouri had suffered severe, permanent brain damage.

In football alone there are countless of examples of heart related incidents, however, heart problems occur in all kinds of athletic endeavours. In 2013, 19-year old Britte Duijn from Groningen (Netherlands) passed away while training, also due to cardiac arrest. The 400 meters runner was revived instantly. However, assessment by the UMC in Groningen, showed that disturbed circulation had caused brain damage that was too great to recover from.

More recently (2019) professional cyclist Robbert de Greef had a cardiac arrest during the cycling race 'Omloop van de Braakman'. He became unwell during the race and was resuscitated for hours. The 27-year-old Alecto Cycling Team cyclist is still in critical condition at a hospital in Antwerp and is fighting for his life.

Causes of cardiac dysrhythmia on the playing field, and its often serious consequences including sudden cardiac death on the playing field remain a mystery for doctors. In-depth medical examination after multiple incidents report no cardiac muscle abnormalities.

Cardiac dysrhythmia in young athletes has several potential causes. However in this (reflection) paper we will not look at cases that are related to hypertrophic cardiomyopathy, ARVD/C, medication (e.g. pain killers), specific stimulation and allergy medication, Brugada syndrome, myocarditis, etc. Instead we will look at cases in which heart failure cannot be explained and usually receive the label: idiopathic cardiomyopathy.

Medical research about dental problems has given us some ideas of where to look when heart diagnostics do not provide answers. Current methods of diagnosis need to be extended by screening the condition of the teeth in order to find potential ‘hidden’ risk factors.

When a patient needs open heart surgery. The heart surgeons first assess the teeth of the patient for potential hidden infections. When a bacterial infection is found, dental surgery is advised before moving on to heart surgery. By observing this procedure we may conclude that there could be a relationship between infection in the mouth and heart problems. The first steps in this direction have already been taken. This paper is meant to start a conversation that will encourage more scientific research about asymptomatic dental (silent) inflammations, periodontitis and pericoronitis, and their effects on cardiac rhythm and, in a worst case scenario, sudden cardiac death in young athletes.

*Periodontitis and pericoronitis*

Periodontitis is linked to increased levels of CRPs (inflammation proteins) and cytokines (among which IL-6 and TNF-a) in the blood. Bacteria in the mouth flora continuously put toxins into the bloodstream.

There is no doubt in the scientific community that there is a relationship between periodontitis and heart problems, rheumatoid arthritis, and diabetes type 2. Research shows that poor oral health negatively impacts general health and that it can lower Hb (hemoglobin) and Ht (hematocrit).

Less commonly known is that elevated CRPs and cytokines contribute to a rapid muscle fatigue. And muscle fatigue is one of the most important causes of inefficient muscle contraction due to a lack of oxygen.

Pericoronitis is gum inflammation around the crowns of teeth or more commonly partly erupted teeth. Pericoronitis is a dental problem that frequently occurs in young people, but it is rarely considered in cardiology.

Usually this starts during the eruption process of the wisdom teeth, which often don't have the space they need in the jaw. It is more common in the lower jaw than in the upper jaw. It is usually caused when the tooth has difficulty erupting. With a partly erupted, impacted lower wisdom tooth there is a space between the crown and the parodontium where bacteria can accumulate. These bacteria cannot be removed with a tooth brush and therefore they're free to wreak havoc.

Explanation of the relationship between arrhythmia and oral inflammation?

To find a hypothetical explanation for our hypothesis comes a clue found in Weston Price's extensive research. Price found that silent inflammation in the mouth 'could lower ionized calcium (Ca++) and increase parathormone, which results in lower levels of thyreocalcitonide, which leads to arrhythmia in the heart. This is directly caused by the role that calcium ions play in the contraction process of the heart muscle.

Ionized calcium ions play a crucial role in biochemical and physiological processes. Calcium is important in signal transduction (the passing on of signals within a cell) where it operates as a second messenger. Calcium is also needed for muscle cell contraction. On top of that, many enzymes demand calcium ions as a coenzyme. Extracellular calcium is important for maintaining a potential difference between cell membranes. This biochemical process convers into an electric pulse when nerve cells and muscle cell respond to each other. Calcium homeostasis is essential in this action potential.

Calcium homeostasis refers to the regulation of the concentration of calcium ions in the extracellular fluid (Ca++). This parameter is tightly controlled because the calcium ions have a stabilizing effect on voltage-gated ion channels.

Every cell is dependent on the presence of ionic calcium. This is also necessary for rhythmic heart function, blood clotting and it plays a significant role during infections and the maintenance of the acid-alkaline balance.

Price showed that most infections in the mouth usually lowers ionized calcium in the blood. And it causes the regular alkaline reserves in the blood to decline while increasing uric acid levels.

High amounts of bone loss due to jaw infections increase ionized calcium (Ca++) levels in the blood. Conversely a lack of calcium ions causes heart weakness, comparable to the effect of too much potassium. On top of that, people with increased Ca++ blood levels appear to develop periodontal illness more frequently, while people with a lower ionized calcium are less likely to develop any kind of periodontal issues [Root Canal Cover-Up, George E. Meinig, 2012. P. 197-200. Price-Pottenger Nutrition Foundation. ISBN 0-916764-09-8].

This is interesting because it connects periodontitis and (asymptomatic) peri-coronitis to increased levels of CRP's (inflammation proteins) and cytokines (among which are IL-6 and TNF-a) in the blood. This is due to mouth flora bacteria that continuously put toxins in the bloodstream.

*Research*

Aside from the usual post-traumatic assessment after an instance of cardiac **dysrhythmia** or worse, **cardiac death**, in 'causa ignota' cases - we should take into account that there are possible other 'hidden' (oral and/or dental) risk factors. Hence we plead for more research of 1. The dental status (which can obtained through an OPG because it shows or excludes the presence of *asymptomatic* pericoronitis or other infections) 2. Clinical research about the periodontal status and 3. Blood- and saliva testing to assess levels of ionized calcium as well as thyreocalcitonide, CRPs and cytokines (IL-6 and TNF-a).

The plea for more research is reinforced by Marciani's 'Is there pathology associated with asymptomatic third molars'. His conclusion is that the absence of disease symptoms, associated with **embedded** or impacted wisdom teeth (one of the causes of pericoronitis) does not equal the **absence** of disease or pathology. Clinical implications of his findings are the foundation of his proposition that, if people choose to keep their wisdom teeth, periodical clinical and radiographic tests are necessary to detect disease before any symptoms manifest.

(Marciani, R.D. Is there pathology associated with asymptomatic third molars. Journal of Oral & Maxillofacial Surgery 2012 September; Volume 70 (Issue 9, Supplement 1):S15-9. Doi: 10.1016/j.joms.2012.04.025

This paper i**s meant to encourage** analysis of possible correlations between teeth, oral health and (acute) heart problems, among adolescents and youth athletes in particular. If one, or several of the previously mentioned risk factors in the mouth for **cardiac dysrhythmia** and/or sudden **cardiac death** can be shown, epidemiological research of predisposing oral health conditions and biochemical status is challenging.

The aforementioned heart problems with a '*causa ignota'* occur in only 2-5% of the target group (young athletes). Thus cases are difficult to find and proper research can only be performed when such events arise. However, I encourage every scientist not to be held back by this research barrier, and to be open to include dental problems as a potential risk factor in heart disease.

Maybe this reflection paper considering oral health can help extend the scope of all future research programs to detect the (potentially lethal) cardiovascular disease in sports in order to reduce or possible to prevent the risk for cardiac arrhythmias and worse, sudden cardiac death in a timely fashion.

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*Recommended literature*

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