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The effect of androgenic anabolic steroid and human growth hormone abuse on oral health - a literature review

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Abstract

Introduction and purpose

The abuse of performance enhancing substances (PES) is a significant issue in competitive sports, especially bodybuilding. Though the umbrella term PES includes many legal and generally healthy supplements such as creatine, it also means illicit substances such as the human growth hormone (HGH) and androgenic anabolic steroids (AAS). Despite abundant research on the subject of AAS and HGH abuse on general health, how they affect the oral cavity and craniofacial bone structures remains severely understudied. The aim of this study is to determine the effects of AAS and HGH abuse on oral health.

Methods

A review of literature available on PubMed, Google Scholar, ScienceDirect (as of March 2025) on the subject of AAS and HGH abuse on oral health.

Results

Both AAS and HGH can have a significant impact on the soft and osseous tissues of the craniofacial complex. The most significant and most often researched effects were acromegaly and periodontitis in case of HGH and AAS respectively. Gingival hyperplasia and increased bone trabeculation have also be observed in AAS abusers. Post-surgical tissue recovery and analgesic metabolism can also be altered by non-therapeutic AAS use.

Conclusion

With more AAS and HGH abusing patients, due to their popularisation on social media, more research on this subject is necessary in order to formulate an appropriate approach to drug abusing patients. AAS and HGH use should be taken into consideration prior to invasive procedures in the oral cavity as well as during periodontal examination.

Key words

androgenic anabolic steroids, human growth hormone, AAS, HGH, oral health, dentistry

Introduction

Performance enhancing substances (PES) have been in use for centuries, though the meaning of the term has evolved over the years.[1] The two PES groups discussed in this study are androgenic anabolic steroids (AAS) and human growth hormone (HGH).

Androgenic anabolic steroids are synthetic derivatives of testosterone with various clinical indications including primary hypogonadism, delayed puberty in boys, catabolism resulting from radiation, Klinefelter syndrome, osteoporosis and various hormonal imbalances. [2, 3]

In many sports however, especially in competitive bodybuilding, AAS are casually abused in order to increase muscle hypertrophy or performance, despite delegalisation in many countries. The lifetime prevalence of AAS use was 3.3% in 2014 and potentially increased to 5% by 2018. [4, 5] Their abuse can have many negative effects on the user's body, including addiction but namely: cardiovascular diseases, such as cardiac fibrosis or hypertension, acne, insulin resistance, tendon tears, higher HDL cholesterol levels, emotional lability and increased libido. [2, 5, 6, 7, 8, 9]
Other adverse effects include infertility, testicular atrophy, prosthatic hypertrophy, gynecomastia in men and breast size reduction, deeper voice, clitoris overgrowth, and male body hair pattern in women. [2, 3, 5, 9, 10]

Research suggests AAS affect androgen receptors in the same way endogenic testosterone does, suggesting they can also affect the oral health. While the effects of testosterone on postoperative wound healing, bone loss and periodontitis in general has been well documented, the effects of AAS and even supraphysiological testosterone doses have not [11, 12, 13]

Human growth hormone was first extracted from the pituitary gland in the 1950s. Surprisingly, it was not until the 1990s that it found a therapeutical use, having been abused by athletes for at least a decade. [1] It has been proven to aid muscle hypertrophy without increasing strength, making it popular mainly among bodybuilders, to whom strength is of lesser importance, as well as increased bone density. [14, 15, 16] Moreover, in the "golden era" of bodybuilding, as the

1970s and 1980s are referred to, proving HGH supplementation was problematic, as it was still a new phenomenon, making it more desirable by "fake natural" athletes, despite the multiple adverse effects such as fluid retention, acromegaly, intracranial hypertension, hyperglycaemia. [1, 17, 16]

While people are becoming increasingly aware of the adverse effects of the above mentioned PES, the effect they can have on oral health are not yet common knowledge, as proven by the lack of research on the subject. [18] This study is an attempt at compiling the evidence to be more accessible for dental practitioners and oromaxillofacial surgeons.

Aim of the study

The aim of this study is to analyse the effects of AAS and HGH abuse has on oral health in humans.

Methods

Review of articles regarding the effects of AAS and HGH abuse on oral health available on PubMed, Google Scholar and ScienceDirect as of March 2025. Filters applied: last 10 years, meta-analysis, systematic review, review, clinical trial, books and documents, randomised controlled trial, keywords: "anabolic steroids", "anabolic steroid", "anabolic steroid abuse", "dentistry", "oral health", "gingiva", "teeth", "periodontium", "periodontitis", "gingivitis", "periodontology", "odontogenic", "oral mucosa", "oral lesions", "temporomandibular", "oromaxillofacial". Due to limited research available, the publication date range was extended to include research dating to 1991 and publication types were also broadened to include reviews and case studies.

Criteria for inclusion: regards oral health in humans; AAS, HGH or ET abuse; written in English, Spanish, Polish or French; at least abstract available. Criteria for exclusion: in-vitro research; oral health not mentioned; physiological or therapeutical doses of AAS, HGH and ET; duplicates; abstract not available; conflict of interests.

Results

Human Growth Hormone

Human Growth Hormone in supraphysiological doses has been known to be the the cause of acromegaly in postpubertal subjects and gigantism in prepubertal ones. [16, 18] The mandible shows abnormal growth, leading to it's protrusion and Angle's III class. Maxillary and zygomatic bones also become more prominent. [18] Subcutaneous tissue overgrowth, combined with facial muscle hypertrophy can lead to overly prominent facial features. The tongue is also affected, with macroglossia being one of the most important oral symptoms of acromegaly, leading to problems with breathing such as sleep apnoea. [16]

Another interesting aspect are the changes in occlusion in juvenile athletes abusing HGH. Other than the above mentioned mandibular protrusion, HGH might cause increased interdental spaces, due to excessive dental arch development. [20] The data supporting this statement, however, is not conclusive and more research is needed. [20]

Other signs of increased HGH levels include gingival hyperplasia, as well as oral symptoms of HGH-induced general diseases such as diabetes mellitus. [16, 17]

Androgenic Anabolic Steroids

Dental health

Limited data on this topic was found and the results were contradictory. While some researchers suggested PES users being more susceptible to caries development, no significant difference was shown for PUFA or DMF in AAS abusers, despite the OHI-S index being higher ($p < 0.01$). [21, 22]

Periodontology

AAS have been proven to correlate with periodontitis prevalence, with more affected sites in the oral cavity ($p = 0.005$) as well as more severe symptoms, such as greater PD ($p = 0.004$). [22, 23] AAS were also found to correlate with gingivitis as well as increased gingiva hypertrophy in case of inflammation, although some results were inconclusive. [2, 23, 24, 25, 26]

Research also shows a significant increase in bacteria such as P. intermedia ($p = 0.003$) and A. actinomycetemcomitans ($p = 0.03$) count as well as subgingival Candida spp. ($p = 0.002$). [24]

Another interesting finding is the lack of correlation between gingival pocket IL-1β and protein concentration with periodontitis in AAS abusers, while present in AAS non-users. [23] Moreover, IL-1β as well as the microbiota appeared in concentrations suggestive of periodontitis in healthy sites in AAS users without clinical symptoms, which may be a sign of the early stages of the disease, explaining AAS users being more prone to it. Studies also show the AAS working on androgenic receptors in the oral mucosa, though the exact effects of this reaction on periodontal health are yet to be verified through clinical trial. [11]

Anaesthesia

AAS taken orally show a hepatotoxic effect, not present in intramuscular administration. [2, 7, 19, 21] This should be taken into consideration when administering amide local anaesthetics such as lidocaine or mepivacaine, as their metabolism may be impaired in oral AAS abusers. They have also been proven to have an additive effect with vasoconstrictors such as epinephrine, commonly used in local anaesthetics. [21]

When general anaesthesia is necessary, AAS use should also be taken into consideration. Studies show a correlation between AAS abuse and increased sodium, potassium and calcium levels, which may affect efficacy of local anaesthetics. AAS induced liver, renal, thyroid and cardiovascular pathologies, electrolytic imbalances and altered drug metabolic rates not only affect the anaesthetic dosage but may potentially be a contraindication. [7, 20, 26] Appropriate tests must be performed even on young patients prior to general anaesthesia.

Surgery

AAS play a major role in postoperative recovery through fibrinolysis induction and vitamin-K-related clotting factors production alteration, which may result in increased prothrombin time and coagulopathy. [7, 21]

Bone healing, on the other hand, was shown to have improved significantly, be it fracture healing, alveolar healing after a tooth extraction or after oromaxillofacial (OMF) surgery, though scarring is more prominent. [7] AAS abuse may also be responsible for fibrous

proliferation of oral mucosa post-surgery, though more research on this subject is necessary. [7, 11]

Increased bone trabeculation in AAS abusers may, however, affect dental and OMF surgery by complicating tooth extractions and maxilla or mandible resections. [7]

Masticatory System

AAS induced muscle hypertrophy also affects masticatory muscles (Skoura et al. 2001). It can therefore be extrapolated that since AAS increase irritability, aggression and masticatory muscle size, bruxism and TMJ disorders will be more prevalent, as shown by several studies [3, 28, 29, 30] Another study suggests that AAS may be responsible for medication-related osteonecrosis (MRONJ) of the jaw. [31] The sample size in the papers analysed was insufficient for generalisation of results and more research is required.

Discussion

Androgenic anabolic steroids influence the oral health both directly and indirectly through androgen receptors in the oral cavity and through symptoms of AAS-induced general diseases. Data on the effect on caries prevalence is contradictory and should be verified through randomised controlled trial (RCT) on a large scale to minimise the risk of researcher bias and verify the findings mentioned in this paper. In fact, apart from gingival hypertrophy and correlation with periodontitis, all of the effects described earlier require more research, as the majority of papers on the subject of AAS abuse are either conducted on a relatively small sample size or are not clinical experiments and therefore unable to directly verify any cause-effect relationship. Some research provided contradicting data, likely due to researcher bias.

Oral symptoms of HGH abuse should also be investigated, as the research available on the topic is close to nonexistent and oral symptoms in most cases were not mentioned directly. No research on the subject of HGH abuse on tissue healing or TMJ disorders has been found. More large-scale RCT are necessary for the proper understanding of the effects HGH has on the oral health.

Conclusion

Both AAS and HGH abuse can play a major role for dental practitioners. It is important to distinguish between HGH or AAS induced gingival proliferation and that caused by periodontal disease, systemic disease and other drugs, which could be an indication for altering the treatment a patient is undergoing.

The effect on tissue healing is also important, as tissue proliferation resulting from AAS needs to be differentiated with malignant growth and should be considered before alarming the patient. Intraoperative hemostasis may also be altered which could lead to difficulties in maintaining a clean operative site in restorative dentistry as well as in surgery where it can obstruct the surgeon's view and lead to post-operative complications.

Increased osseous trabeculation, resulting from AAS abuse, could potentially affect surgical procedure planning, as root separation might be necessary for a minimally invasive procedure and implant osseointegration can be significantly improved allowing for a more standard approach despite bone tissue degeneration.

The subject of PES abuse on dentistry is much overlooked and further research is necessary for better treatment of AAS or HGH abusing patients.

Disclosure

No disclosure is necessary.

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Conflict of Interest Statement

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