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HISTORY, DEVELOPMENT, EQUIPMENT AND PRINCIPLES OF THERAPY – WHAT’S WORKING AND WHAT ISN’T?

Introduction

Dentistry in humans has developed rapidly over the last 100 years. Before around 1920, most teeth that were diseased were extracted, or the owner of the teeth would have had to live in misery, and possibly suffer complications such as septicaemia and possible death.

The benefits of restoring teeth are multiple and include continued use for mastication, prevention of deterioration of decay and other disease, protection of the vital pulp from sepsis as well as cosmetic enhancement. For horses (apart from the cosmetics..) the benefits are similar however the continued eruption of the opposing antagonist teeth following extraction due to hypsodonty, the mesial drift and unpredictable closure of the extraction gap, as well as the high complication rates often reported with dental extractions mean further benefits of restorative or preservative therapy of teeth. Treatments have been employed to overcome and prevent some of these complications following extraction, such as insertion of prosthetic bone blocks in place of teeth for prevention of mesial drift, however these have to date been unsuccessful. Complication rates for dental extractions in horses employing new technologies and methods have reduced however significant complications will always be a risk of any surgical procedure.

Thanks to other significant advances in equine veterinary medicine and surgery, increased owner awareness of disease syndromes (e.g. Cushing’s Disease), increased owner compliance, education, a shift in the demographic of the horse owning public, horses are living to greater ages than ever before (on average) with many horses still competing at high level in various disciplines well into their twenties. Key to this is having good dentition, and for good dentition in old age, there has to be a preventative and prophylactic approach, just as in humans. Early recognition of disease is key,

advising owners that ‘symptoms’ of dental disease in the early stages. Geriatric care is becoming increasingly important in equine practice and equine dentistry has to expand and develop in line with other advances in veterinary science through early recognition of disease. Through developing endodontic and restorative procedures horse should live through their 20s with all their own teeth.

A current definition of (human) dentistry is ‘the treatment of diseases and other conditions that affect the teeth and gums, especially the repair and extraction of teeth and the insertion of artificial ones’ (Oxford Living Dictionary, 2018). Early historical texts mention the ‘tooth puller’ and many ancient paintings depict similar forceps used for extraction of diseased teeth. Endodontic and restorative dentistry took many years to develop, and is a comparatively recent development, but there is evidence that the Maya and other ancient cultures used primitive “bow drills” and other devices to prepare round ornamental cavities in teeth. Some early attempts at filling teeth are also in evidence. Progression of dentistry as a science as far as the current definition above progressed rapidly in the last 150 years. Early developments included anaesthetics and anaesthesia, steel burs, hand drills, mechanical drill devices, adaptations for accessing the caudal teeth, dental radiology, hygienists to help education. Later came electricity (late 1800’s), high speed drills, the dental chair, air turbine drills and electric drills with higher torque and mass produced steel and diamond dental burs. Widespread use of filling materials for cavities began with gutta percha, a type of rubber, often known as a ‘stopper’ but there are reports of use of lint, lead, gold, mastic from as early as the first century AD⁽¹⁾. Various other materials were used, but the prevailing material, originally manufactured from French 5-franc pieces and mercury was known as amalgam, and a stable formula created in 1895 prevailed until the 1960s saving countless millions of teeth. An alternative, a silicate cement which developed to a composite resin is now the most popular type of restorative however forms of amalgam and gutta percha are still in existence today.

In equine dentistry, there is scant evidence of any other technique than extraction of teeth before the last 15 years. Diseases of teeth such as periodontal disease and caries were noted⁽²⁾, and reported, but references to treatments are limited. Amazingly in the late 1800s there are detailed descriptions of practising and teaching the filling of

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infundibular cavities using gutta percha, resins and amalgam for equine infundibular and pulp cavities⁽³⁾. The conclusion of the author seem very relevant today 'many teeth may be saved by restorative techniques but when the disease has progressed too far then extraction is the only option'.

Principles of therapy

Endodontic techniques are categorised by the vitality of the pulp, type of pulp insult, and in horses by the presence or absence (through attrition) of occlusal secondary dentine. Irreversibly inflamed pulp must be completely removed, the pulp cavity cleaned and disinfecting, before filling ('obturating') with some inert dental replacement filling. For equine teeth, due to continued eruption and attrition, this filling material should eventually be able to withstand the occlusal pressures of mastication, making some traditional materials e.g. gutta percha unusable.

True endodontic therapy in horses, accessing the non-vital or irreversibly inflamed pulp from the occlusal aspect is a technically challenging technique which requires considerable training and experience⁽⁴⁾. The simple pulp system of incisors means a less complex approach is required. For cheek teeth, open, food filled cavities of chronic pulp death or infundibular caries are less complex than true endodontics but still can be challenging to perform properly.

Cavity restorations (infundibular or pulp, through occlusal exposure) can be cleaned and disinfected using endodontic materials and techniques and the resultant filling should:

1. Protect the vital pulp
2. Restore the tooth to masticatory function
3. Prevent caries progression

Techniques that are currently being used successfully include:

- Direct pulp capping of fractured teeth (incisors, canines)
- Incisor root canal therapy for septic pulpitis
- Non-vital pulp therapy for cheek teeth with occlusal pulpar exposure
- Infundibular caries restorations (grade 3-4)
- Patent infundibula treatment⁽⁵⁾

Techniques that have limited evidence, are still research projects or less successful:

- Occlusal cheek tooth endodontic therapy in young and aged horses
- Extraction, endodontic therapy and replantation of cheek teeth
- Any endodontic / restorative therapy on chronically diseased teeth with advanced pulpitis

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