

# The AGP Question; Implications for Orthodontics

## Introduction

At the time of publishing this advice sheet there has been limited guidance from PHE on the implications of Aerosol Generating Procedures (AGP's) for the practice of orthodontics once we return to clinical work. Current guidance from PHE, states that dental turbines create an AGP but it is clear that there are two essential factors to consider: The production of the aerosol (or splatter) itself and whether, within an aerosol (or splatter) that is produced, there is a viral load that could be considered a danger to our patient, ourselves or others.

Current National guidance on treatment of patients in the Covid-19 era advises limitation of AGP's. It cannot be guaranteed that there is no viral load (specifically Covid-19) in the aerosol. For this reason, and in order not to overload our emergency medical services, no routine dental care (including orthodontics) is currently being carried out.

Centres where dental emergencies are being undertaken focus on limiting AGP procedures. If they have to be produced then appropriate PPE and High Volume Suction are used. Appropriate decontamination and clean down is required after the procedures have been completed.

The BOS recognises that it is not a legislative body and does not produce regulations that require to be adhered to. These can only come from the regulatory bodies in England, Northern Ireland, Scotland and Wales. The BOS does feel, however, that providing a review of the evidence on AGP's is within its remit as a specialist society looking after the welfare of members of the public, clinicians and staff during the delivery of orthodontic care.

This document clearly identifies the procedures that will produce an aerosol and/or splatter. If the virus is present these procedures present a risk of transmission. The BOS feels that a full understanding of AGP generating procedures will enable practitioners to make a risk assessment of the patient/procedure/clinic and determine the likely danger of disease transmission, when individual sensitivity is not understood.

As dental practices re-open and orthodontics recommences it will be incumbent on each practitioner to ensure that they are satisfied that they are able to provide treatment which is safe for all. That will include an understanding of the correct PPE required for the procedure chosen on the individual under their care, to protect members of the public, their staff and themselves.

The BOS suggests its members should mitigate the potential risk of AGP's, or consider providing treatment without creating AGP's where possible. **Once the risk of AGP's, viral load and transmission are more fully understood scientifically we expect this advice to change.** This fact sheet presents a review of aerosols produced in orthodontics to enable individual practitioners to make a valid and reliable judgement as to the risks involved when carrying out orthodontic treatment.

The BOS is hopeful that in the fullness of time, with antigen testing, the development of antibody testing and eventual vaccine the concern with AGP's will become less of an issue and our daily working practices will be able to return towards normal and the lessons learnt during the covid-19 pandemic will elevate our clinical practice not harm it.

## What is an AGP

An **aerosol** is a suspension of fine solid particles or liquid droplets in air or another gas.<sup>1</sup>

An aerosol can comprise solid particles or liquid droplets of varying size within the air and in addition these may or may not include bacteria, fungi and viruses. How these particles (solid or liquid) will behave in air is dependent very much on their size, shape and mass. Very large particles may have a ballistic trajectory and land on surfaces close to where they are generated. In dentistry this may be nearby work tops, the dental chair or the operator/ assistant. This is why, in the current COVID-19 pandemic in particular, in order to prevent indirect spread, eye and face protection is recommended.

Some of these large particles may also be inhaled and enter the nose or mouth. However, smaller particles with a mass median aerodynamic diameter of around 10µm or less can enter the upper respiratory tract, and those particles that are even smaller, less than 4.25µm in diameter, can reach the deeper parts of the lungs.

**Aerosol Generating Procedures (AGPs)** are defined as any medical and patient care procedure that results in the production of airborne particles (aerosols). These are relevant to COVID-19 transmission, since this may occur via both direct air-borne infection and indirect spread via contact with contaminated surfaces. Restriction of AGPs is, therefore, an important control measure.<sup>2</sup>

Each Nation's guidance<sup>2-5</sup> suggests parameters of dental AGPs, but with some disparity between them. They acknowledge the list is not exhaustive and state '*Not all dental procedures have been covered*'.<sup>2</sup>

**Where AGP has to be undertaken, this should be in accordance with current National Guidance<sup>2,3,4,5</sup>, with appropriate PPE and management of the clinical environment.**

Based on the most up to date information available<sup>6-17</sup> dental AGP's are produced when using any of the following:

- High speed air rotor drills including surgical drills<sup>6,7,8,10,11,14,16</sup>
- Slow speed drills, run wet and dry, including surgical drills<sup>9,10,12,13,14,17</sup>
- 3 in 1 spray or air/water syringes<sup>7,8,14</sup>
- Ultrasonic and sonic handpieces<sup>7,8,14</sup>
- Air abrasion or intra oral sandblasting<sup>14,15</sup>

For **orthodontics** this extrapolates for our procedures to include use of high speed air turbine or slow speed rotary drill, 3 in 1 air/water syringe, and enamel preparation using ultrasonic or air abrasion devices.

This will have a direct impact on adhesive removal from enamel, and the use of air/water sprays and rotary handpieces for moisture control and cleaning.

Even with the use of High Volume Suction (HVE) and rubber dam and a pre procedural mouthwash to limit aerosol and the bio impact, these procedures are still considered AGPs and appropriate PPE should be worn, along with appropriate decontamination protocols in the surgery.

High and low volume suction themselves are NOT considered AGPs.

## Alternatives to AGP in the orthodontic setting

### Debond

Removal of brackets and wires alone is not considered the AGP part of a debond. Use of a handpiece, (high speed or slow speed, with or without water coolant) ultrasonic scaler or 3 in 1 air/water spray should be avoided.

For patients with poor oral hygiene where the risk of continuing treatment is high, consideration could be given to removing the brackets alone and hand trimming the adhesive carefully using:

- band removing pliers,
- Mitchell's trimmers or hand scalers,
- adhesive removing pliers.

Any small remnants of composite left on the enamel surface are likely to be lost over time with toothbrushing.

There is no more enamel loss when using debanding pliers than with slow speed Tungsten Carbide bur run dry,<sup>18</sup> but take care not to gouge the enamel surface. Pliers should only be used to remove the adhesive on posterior teeth, not the incisors where a Mitchell's trimmer or hand scaler should be used instead. If there are large restorations on the posterior teeth consider placing a cotton wool roll on the occlusal surface before applying any force with the plier.

### Repair of brackets mid treatment

As above, if residual composite can be removed by hand, this may enable a new bracket to be placed (using a Non AGP bonding technique - see below). Alternative options would be to place a premolar or molar band using GIC, or to bypass the debonded tooth, using dead coil or sleeve on the wire, or using sectional wires mesial to the debonded tooth.

### Removal of fixed devices mid treatment

Removal of fixed devices such as Bands, TPA Nance arches, Quad helix and RME devices only becomes an AGP if a handpiece is used to remove the residual cement. As above, consider adhesive removal using hand instruments.

### Bonding

Conventional acid etch bond up protocols are AGP when using polishing/pumice prior to etching and the 3 in1 air syringe to rinse the enamel after etching. *Alternative non AGP options are listed, but it should be recognised that bond strength may be compromised:*

*Light cured resin modified GIC, can be used without the need for any pre procedural tooth preparation (i.e. pumicing/etching washing/ drying). With these materials there is NO need for a dry field and indeed for successful bonding the enamel surface should remain moist during bonding.<sup>19</sup>*

*Self etch primers (SEP) can also be used without the need for etching washing and drying the enamel, but they require the pellicle to be removed prior to use, usually with a pre procedural enamel*

preparation such as pumice/polishing of teeth, which would be an unwanted aerosol. Without this stage the bond strength is likely to be reduced.<sup>20,21</sup> To avoid the use of a pumice/polishing of teeth using a handpiece and 3 in 1 syringe with SEP:

- Wipe the bonding surface of the tooth with a cotton roll prior to applying SEP.
- Suction may be used as this is non AGP.
- The [Technique](#) for using SEP is also important, with 3-5 seconds rubbing of the SEP to enamel, with re-dip into the SEP reservoir before repeating on each subsequent tooth. Following application of the SEP some manufacturers recommend gentle air drying. This latter stage is potentially an AGP and should be avoided

## **Bands**

Avoid the use of 3 in 1 due to the aerosol hazard, but suction may be used. The use of GIC or resin modified GIC doesn't not require a completely dry field on either the tooth or band prior to placement

## **Fitting and trimming the acrylic on removable appliances**

It should be borne in mind that removable appliances may act as a conduit for cross infection, and laboratory protocols should be adhered to in order to minimise this risk. Although new appliances cannot be assumed to be infection free<sup>22</sup>, strict adherence to laboratory infection control procedures including processing of impressions, equipment and appliances is crucial in minimising the risk of any cross infection. Simple fitting and adjustment of a removable appliance is not likely to be an AGP provided no acrylic trimming is required during fitting i.e. after try-in.

In the case of appliances already being worn by the patient that require repair and refitting, they should be decontaminated according to HTM01-05<sup>23</sup> protocol and current PHE cross infection guidance<sup>24</sup>, using an appropriate disinfectant before ideally being transferred to the laboratory for repair, where superior high volume suction can be used to minimise the impact of any aerosol generated.<sup>25</sup>

Often removable appliance acrylic trimming would be undertaken at the chairside in the clinical setting, either as part of the fitting procedure for a new appliance, or following the repair of a worn appliance. There is currently a paucity of evidence in the literature on the microbial load on a worn or tried in orthodontic appliance made from acrylic following disinfection, and no evidence that any aerosol generated during trimming is therefore not a biohazard risk. Acrylic trimming of a new but tried in appliance or currently worn appliance in the surgery should therefore be **considered an AGP**.

## **Repair of Fixed retainers**

Removal of adhesive from the retainer wire can be achieved using Weingart or Birdbeak pliers, and HVE (High Volume Evacuation/Suction).

Adhesive removal from the lingual surface of the incisors may be achieved using hand scalers or Mitchell's trimmers, or the use of adhesive removal pliers.

## **Aligner Attachments**

Placement of aligner attachments can be considered non-AGP if placed using bonding technique as suggested above.

Removal of attachments will be non-AGP if using adhesive removal tool as suggested and will only be considered AGP if a handpiece is used to remove the residual composite.

### **Taking impressions**

An impression in itself is not an AGP, but carries a risk of gag or cough reflex which is a known aerosol risk. Where accessible, an intra oral scan may be preferable (although this does not eliminate the gag/cough risk).

Any impressions should be sterilised<sup>22</sup> in accordance with HTM01-05 protocol<sup>23</sup> to ensure safe transfer to the laboratory for casting and appliance production.

### **Retention**

Consideration should be given to changing to using a removable retainer regime. This could be made over the remnants of a broken fixed retainer.

## **Minimising the impact of Aerosol Generation when performed within the clinical environment**

### **High volume suction (HVE)**

The use of high volume suction (HVE) **is established as significantly reducing the amount of aerosol** in the environment and **should be employed if AGP is used**, including when trimming appliances outside of the mouth.<sup>5,12-14,26-31</sup>

### **Rubber dam**

The use of rubber dam to reduce the biodiversity of aerosol has been suggested.<sup>5,14,29,31</sup> Studies are very varied in confirming the impact of rubber dam in reducing the biodiversity of aerosol produced.<sup>32-34</sup> It is certainly a technique sensitive procedure and this may account for the variability of results in studies. The practical implications in orthodontics are limited, where multiple teeth are being treated and it is unlikely to be a technique operators are skilled in at present.

### **Pre-procedural mouth-rinse**

Although both Chlorhexidene and H<sub>2</sub>O<sub>2</sub> mouthwash have been shown to reduce the bacterial load of aerosols, Chlorhexidine is not known to be effective against coronavirus.<sup>16</sup> It has been suggested that since the virus may be vulnerable to oxidation, a pre-procedural mouth-rinse with an oxidising mouthwash may be worthwhile,<sup>14,16,29,35</sup> such as with H<sub>2</sub>O<sub>2</sub>, Hypochlorous acid or povidone iodine.<sup>31,36,37</sup> However, a clinical study examining the bacterial loading of aerosols generated at orthodontic debond found that the use of preprocedural mouthwash (either sterile water or Chlorhexidine) actually *increased* the biodiversity within the aerosol generated at debond rather than reducing it. This was the case even when using a slow speed handpiece without water coolant to remove the residual adhesive.<sup>17</sup>

High viral loads have been found in the oro<sup>38</sup> and naso<sup>36</sup> pharynx of infected patients, as well as in positive, but asymptomatic subjects. Since Coronavirus is expelled from the lungs at each exhalation there is some limitation to the impact of such a pre-procedural mouthwash, even if it was effective in reducing the viral load.<sup>39</sup> The pre procedural use of 0.5% povidone iodine both as a mouthwash and nasal spray has been suggested as a disinfectant for patients attending for dentistry/oral surgery, and in addition for health care workers providing the treatment, repeated 2-4 hourly if repeated patients are seen<sup>36</sup>.

### Face masks

There are 2 main types of face mask; Fluid resistant surgical masks (type IIR) and respirator masks; FFP2 and FFP3 according to filtration rates. Masks have been shown to be effective against nosocomial transmissions of SARS. <sup>40</sup>

Studies have shown up to 95% filtration rate with surgical masks<sup>12,13</sup>, but many studies looking at types of mask and the effect of filtration tend to be laboratory based, and do not correlate with the real world issues of namely exhalation as well as inhalation, the impact of moisture on the efficiency of the mask, the fit of the mask to the individual face and the impact of facial movement on the fit during episodes of wear. The filtering efficiency of a mask is only as good as its fit and seal or the moisture content. Therefore, masks and respirators should be fit tested, checked and always discarded if moist/wet or the seal is broken.<sup>30</sup>

The most recent guidance from PHE<sup>41</sup> states that the following (dental) procedure is 'currently considered to be a potentially infectious AGP for COVID-19

- Some dental procedures (for example high speed drilling)

The BOS guidance however does highlight the possible concern about particle spread with other rotary and air driven instruments and 3:1 syringes and advises additional caution should be exercised until further clarification is given.

WHO continues to recommend airborne precautions for circumstances and settings in which aerosol generating procedures and support treatment are performed<sup>42</sup>, according to risk assessment. Current WHO recommendations emphasise the importance of rational and appropriate use of all PPE, not only masks, which requires correct and rigorous behaviour from health care workers, particularly in doffing procedures and hand hygiene practices.

## References

1. William C. Hinds. Aerosol Technology: Properties, Behavior, and Measurement of Airborne Particles, 2nd Edition ISBN: 978-0-471-19410-1 February 1999.
2. Letter from Scottish CDO 18 3 2020, with Annex on AGP.  
[https://www.gdc-uk.org/docs/default-source/covid-19/use-of-aerosol-generating-procedures-\(agps\).pdf?sfvrsn=5a95b3b3\\_2](https://www.gdc-uk.org/docs/default-source/covid-19/use-of-aerosol-generating-procedures-(agps).pdf?sfvrsn=5a95b3b3_2) Accessed 5th May 2020.
3. Scotland  
<https://www.scottishdental.org/wp-content/uploads/2020/04/HPS-Urgent-Dental-Care-COVID-19-April-11.pdf> Accessed 5th May 2020.
4. Wales  
[https://www.gdc-uk.org/docs/default-source/professional-conduct-committee/2020-04-03---red-alert-phase-escalation-pdf.pdf?sfvrsn=df02fdcd\\_2](https://www.gdc-uk.org/docs/default-source/professional-conduct-committee/2020-04-03---red-alert-phase-escalation-pdf.pdf?sfvrsn=df02fdcd_2)  
(appendix 5) with a link to <https://www.yumpu.com/en/document/read/63158133/aerosol-generating-procedures-v2> for detail on AGP and Non AGP procedures. Accessed 5th May 2020.
5. England and NI  
<https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/04/C0282-covid-19-urgent-dental-care-sop.pdf> (appendix 3) Accessed 5th May 2020.
6. Toroglu MS, Haytac MC, Koksall F.  
Evaluation of aerosol contamination during debonding procedures. Angle Orthod 2001,71: 299-306.  
[doi.org/10.1043/0003-3219\(2001\)071<0299:EOACDD>2.0.CO;2](https://doi.org/10.1043/0003-3219(2001)071<0299:EOACDD>2.0.CO;2)
7. Harrel SK, Mollinari J.  
Aerosols and splatter in Dentistry: A brief review of the literature and infection control implications  
JADA 2004, 135: 429-437  
[doi.org/10.14219/jada.archive.2004.0207](https://doi.org/10.14219/jada.archive.2004.0207)
8. Harte J.  
Standard and Transmission-Based Precautions: An Update for Dentistry JADA 2010, 141: 572-581  
[doi.org/10.14219/jada.archive.2010.0232](https://doi.org/10.14219/jada.archive.2010.0232)
9. Ireland AJ, Moreno T, Price R.  
Airborne particles produced during enamel cleanup after removal of orthodontic appliances. AJODO 2003, 124: 683-686  
[https://doi.org/10.1016/S0889-5406\(03\)00623-1](https://doi.org/10.1016/S0889-5406(03)00623-1)
10. Day CJ, Price R, Sandy JR, Ireland AJ.  
Inhalation of aerosols produced during the removal of fixed orthodontic appliances: a comparison of 4 enamel cleanup methods. AJODO 2008, 133: 11-17  
<https://doi.org/10.1016/j.ajodo.2006.01.049>
11. Day CJ, Sandy JR, Ireland AJ  
Aerosols and Splatter in Dentistry – a neglected menace? Dental Update 2006. 33: 601-606  
<https://doi.org/10.12968/denu.2006.33.10.601>
12. Johnston NJ, Price R, Day CJ, Sandy JR, Ireland AJ  
Quantitative and qualitative analysis of particulate production during simulated clinical orthodontic debonds. Dental Materials 2009, 25: 1155-1162  
<https://doi.org/10.1016/j.dental.2009.04.002>

13. Vig P, Attack NE, Sandy JR, Sherriff M, Ireland AJ  
Particulate production during debonding of fixed appliances: laboratory investigation and randomized clinical trial to assess the effect of using flash-free ceramic brackets. *AJODO* 2019, 155: 767-778  
<https://doi.org/10.1016/j.ajodo.2019.02.010>
14. Howe MS.  
How much extra protection does an FFP3 mask offer in the dental surgery? [Dental Elf](#) post 30.4.2020. Accessed 5th May 2020.
15. Gerbo LR, Barnes CM, Leinfledder KF  
Applications of the air-powder polisher in clinical orthodontics. *Am J Orthod Dentofacial Orthop* 1993, 103: 71-73  
[https://doi.org/10.1016/0889-5406\(93\)70109-2](https://doi.org/10.1016/0889-5406(93)70109-2)
16. Arshad F, Kumar HC, Swamy GS, Lokesh NK, Begum S.  
Comparative effectuality of two pre-procedural mouthwashes during debonding - A clinical study. *J Indian Orthod Soc* 2018;52:248-54.  
[DOI:10.4103/jios.jios\\_245\\_17](https://doi.org/10.4103/jios.jios_245_17)
17. Dawson M, Soro V, Dymock D, Price R, Griffiths H, Dudding T, Sandy JR, Ireland AJ.  
Microbiological assessment of aerosol generated during debond of fixed orthodontic appliances. *AJODO* 2016, 150: 831-828  
<https://doi.org/10.1016/j.ajodo.2016.04.022>
18. Ireland AJ, Hosein I, Sherriff M  
Enamel loss at bond up, debond and clean up following the use of a conventional light cured composite and a resin modified glass polyalkenoate cement. *European Journal of Orthodontics* 2005. 27, 413 – 419  
<https://doi.org/10.1093/ejo/cji031>
19. Ireland AJ and Sherriff 2002  
The effect of pumicing on the in vivo use of a resin modified glass poly(alkenoate) cement and a conventional no-mix composite for bonding orthodontic brackets. *Journal of Orthodontics* 2002, 29, 217 – 220  
<https://doi.org/10.1093/ortho/29.3.217>
20. Ireland AJ Knight H, Sherriff M  
An in vivo investigation into bond failure rates with a new self-etching primer system. *AJODO* 2003, 124: 323 – 326  
DOI:[10.1016/s0889-5406\(03\)00403-7](https://doi.org/10.1016/s0889-5406(03)00403-7)
21. Aljubouri YD, Millett DT, Gilmour WH  
Six and 12 months' evaluation of a self-etching primer versus two-stage etch and prime for orthodontic bonding: a randomized clinical trial. *European Journal of Orthodontics*. 2004, 26: 565-571  
<https://doi.org/10.1093/ejo/26.6.565>
22. Barker CS, Soro V, Dymock, D, Sandy JR, Ireland AJ.  
Microbial contamination of laboratory constructed removable orthodontic appliances. *Clinical Oral Investigations* 2014, 18: 2193-2202  
<https://doi.org/10.1007/s00784-014-1203-8>

23. HTM 01-05  
Decontamination in primary care dental practices (HTM 01-05) 2013  
Health Technical memorandum 01-05 advice on safety when decontaminating reusable instruments in primary care dental practices.  
<https://www.gov.uk/government/publications/decontamination-in-primary-care-dental-practices>  
Accessed 5th May 2020.
24. GOV.UK, Public Health England: [Reducing the risk of transmission of COVID-19 in the hospital setting](#)  
Published 27.4.2020. Accessed 5th May 2020.
25. Ireland AJ, Wilson A, Blythe L, Johnston NJ, Price R, Sandy JR.  
Particulate production during orthodontic laboratory procedures. Journal of Exposure Science and Environmental Epidemiology 2011, 21: 536-540.  
[doi:10.1038/jes.2011.26](https://doi.org/10.1038/jes.2011.26)
26. Harrel SK, Barnes JB, Rivera-Hidalgo F  
Reduction of aerosols produced by ultrasonic scalers. Journal of periodontology 1996, 67: 28-32.  
<https://doi.org/10.1902/jop.1996.67.1.28>
27. Devker N, Mohitey J, Vibhute A, Chouan VS, Chavan P, Malagi S, Joseph R.  
A study to evaluate and compare the efficacy of pre procedural mouthrinsing and high volume evacuator attachment alone and in combination in reducing the amount of viable aerosols produced during ultrasonic scaling procedure. J Contemp Pract 2012 1;13: 681-9  
DOI: [10.5005/jp-journals-10024-1209](https://doi.org/10.5005/jp-journals-10024-1209)
28. Jacks ME.  
A laboratory comparison of evacuation devices on aerosol reduction. Journal of dental hygiene: 2002; 76, 202-206.
29. Peng X, Xu X, Li Y, Cheng L, Zhou Z, Ren Bet al 2020  
Transmission routes of 2019 -nCoV and controls in dental practice. Int J Oral Science 2020, (12) 9  
<https://doi.org/10.1038/s41368-020-0075-9>
30. Li RWK, Leung KWC, Sun FCS, Samaranayake LP  
Severe Acute Respiratory Syndrome (SARS) and the GDP. Part II: Implications for GDPs. Br Dent J. 2004, 197: 130–134.  
doi: [10.1038/sj.bdj.4811522](https://doi.org/10.1038/sj.bdj.4811522)
31. Izzetti R, Nisi M, Gabriele M, Graziani F  
COVID-19 Transmission in Dental Practice: Brief Review of Preventive Measures in Italy  
Journal of Dental Research Online First 17.4.2020  
<https://doi.org/10.1177/0022034520920580>
32. Cochran MA, Miller CH, Sheldrake MA  
The efficacy of the rubber dam as a barrier to the spread of microorganisms during dental treatment. The Journal of the American Dental Association. 1989, 119: 141-144.  
<https://doi.org/10.14219/jada.archive.1989.0131>
33. Samaranayake LP, Reid J, Evans D.  
The efficacy of rubber dam isolation in reducing atmospheric bacterial contamination. ASDC J Dent Child, 1989, 56: 442-444.

34. Al-Amad SH, Awad MA, Adher FM, Shahramian K, Omran TA.  
The effect of rubber dam on atmospheric bacterial aerosols during restorative dentistry. *Journal Infect public health*, 2017,10: 195-200.  
[doi: 10.1016/j.jiph.2016.04.014](https://doi.org/10.1016/j.jiph.2016.04.014).
35. Carrouel F, Conte MP, Fisher J, Goncalves LS, Dussart C, Llodra JC, Bourgeois D  
COVID-19: A Recommendation to Examine the Effect of Mouthrinses with  $\beta$ -Cyclodextrin Combined with Citrox in Preventing Infection and Progression. [J Clin Medicine online publication 15 4 2020](#)  
Accessed 5<sup>th</sup> May 2020.
36. Kirk-Bayley J, Combes J, Sunkaraneni V, Challacombe S.  
The Use of Povidone Iodine Nasal Spray and Mouthwash During the Current COVID-19 Pandemic May Reduce Cross Infection and Protect Healthcare Workers (March 28, 2020)  
<https://ssrn.com/abstract=3563092> or <http://dx.doi.org/10.2139/ssrn.3563092> Accessed 5<sup>th</sup> May 2020
37. Meng L, Hua F, Bian Z.  
Coronavirus Disease 2019 (COVID-19): Emerging and Future Challenges for Dental and Oral Medicine, *J Dent Res*. 2020, 99: 481-487  
[DOI: 10.1177/002203452091424](https://doi.org/10.1177/002203452091424)
38. Zou L, Ruan F, Liang L, Huang H, Hong Z, Yu J, Kang M, Song Y, Xia J, Guo Q, Song T He J, Yen HL, Peiris M, Wu J  
SARS-CoV-2 Viral Load in Upper Respiratory Specimens of Infected Patients.  
*N. Engl. J. Med*. 2020, 382: 1177–1179  
[DOI: 10.1056/NEJMc2001737](https://doi.org/10.1056/NEJMc2001737)
39. AAO video: Should Dentists Have Patients Use Hydrogen Peroxide or Povidone Mouthrinses Before Procedures?  
<https://www.youtube.com/watch?v=iPcjl-ztkG8> Accessed 5<sup>th</sup> May 2020.
40. Seto WH, Tsang D, Yung RW, Ching TY, HO M, HO LM, Peiris JSM.  
Effectiveness of precautions against droplets and contact in prevention of nosocomial transmission of severe acute respiratory syndrome (SARS) *Lancet*. 2003, 361: 1519–1520.  
[doi: 10.1016/S0140-6736\(03\)13168-6](https://doi.org/10.1016/S0140-6736(03)13168-6)
41. PHE Covid-19 personal protective equipment (PPE)  
<https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control/covid-19-personal-protective-equipment-ppe#ppe-guidance-by-healthcare-context>  
section 8.1 Aerosol Generating Procedures,  
linked to Evidence on Aerosol generating procedures (AGP) NHS National Services Scotland, Heath Protection Scotland.  
[https://hpspubsrepo.blob.core.windows.net/hps-website/nss/2893/documents/1\\_tbp-lr-agp-v1.pdf](https://hpspubsrepo.blob.core.windows.net/hps-website/nss/2893/documents/1_tbp-lr-agp-v1.pdf)  
Accessed 5<sup>th</sup> May 2020
42. WHO: Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations. Scientific Brief, Published 29.3.2020  
<https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations> Accessed 5<sup>th</sup> May 2020.