



dentair

MARKET RESEARCH



Market Research

Direct competitors:

1. AIRVIA
2. Dyson
3. IQAir
4. Radic8 — VirusKiller
5. WoodPecker

Indirect competitors:

1. Suction and vacuum stations - IQAir Dental Hg™
2. Hospital grade air filtration systems
3. Filtration attachments for pre existing ventilation units



AIRVIA PRO 150 Air Purifier

Product statement:

Not marketed for dental practices or any AGP facilities - marketed for offices and general medical practices.

USPs:

- » Ionisation (diffusion of negative ions in the air) which attract fine particles of >PM 0.1. "AIRVIA Medical uses a unique technology with an unrivalled power of 20 million pcs/cm³ at the output". Advertises fighting particles of tobacco smoke, bacteria, and viruses, among others. The ionisation function can be easily activated or deactivated as desired.
- » Two natural sterilisation processes: UV rays and lysozyme which can be activated and deactivated at will.
- » Pre filter available depending on your needs; real time display of formaldehyde concentration, PM concentration, room temperature, and room humidity level.
- » Night mode - continues to clean your air while saving energy
- » Can filter P4 CCM - highest possible grade
- » No ozone production

Filtration:

1. Pre filter
2. HEPA filter H13
3. Bacteria separation filter
4. Activated charcoal filter
5. Absorption filter with molecular sieve
6. Photo catalyst purification
7. UV sterilisation
8. Negative ions purification

Price: £889-£1099

Website information:

<https://www.airpurifier.co.uk/products/airvia-pro-150-air-purifier>

Location: France

Dyson Pure Hot + Cool™

Product statement:

To simultaneously purify and heat a whole room properly, the Dyson Pure Hot+Cool™ purifier fan heater goes beyond standard tests by automatically sensing pollution, capturing ultrafine pollutants, and projecting purified and heated air using Air Multiplier™ technology. It is the only purifying heater designed and tested to do this.

USPs:

- » Can heat and cool rooms
- » Automatically senses air pollution
- » Diffused air can be diverted through the back of the machine to purify without cooling
- » Night time mode
- » Using a unique algorithm, it processes the input to provide real time indoor air quality reports

Filtration:

- » Activated carbon filters remove gases
- » Sealed glass HEPA filters capture 99.95% of ultra fine particles such as allergens and pollutants

Price: £549

(2 year guarantee and 35 day money back guarantee)

Website information:

<https://www.dyson.co.uk/purifiers/dyson-pure-hot-cool-technology.html>

Location: Can be bought in U.K retailers

IQAir: Dental Pro

Product statement:

The Dental Pro has been designed to remove a wide range of chemical contaminants, including mercury vapours, from dental surgeries and clinics. It will remove at least 99% of all airborne particulate, aerosol, allergen and micro-organism contamination.

For over 50 years, the IQAir Group has been an industry leader for indoor air quality. IQAir systems are built exclusively in Switzerland to the highest quality standards and in accordance with strict international norms. Leading institutions around the world are relying on IQAir to protect against airborne infectious diseases, toxic chemicals and particulate contaminants.

USPs:

- » Individually tested, certified and guaranteed; special mercury binding media; can attach flexible suction duct; patented IQAir housing design permits quick and safe replacement of the individual filter elements without any tools

Filtration:

1. GC Pre-filter H11 (S) - removes particulate contamination before it can reach the activated carbon stage, thus extending filter life (filter service life: 6-12 months). This strips the air of bacteria, viruses, allergens and larger aerosols
2. Dental Pro filter cartridge set - 5kg of highest grade granular impregnated activated carbon (AC 4-S) and impregnated alumina is housed in four cylindrical shaped cartridges. (filter service life: 12-24 months). Depending on the model these gas filters remove VOCs, mercury, vapour, formaldehyde, glutaraldehyde, odours and many other chemical contaminants
3. GC Post-Filter Sleeve set - adds another HEPA class 2 filter, which stops particles produced as a by product of stage 2 being released by the system (filter service life: 12-24 months). This is an electrostatically charged post filter which traps even the smallest of particulate pollutants and microorganisms

Price: \$1449-\$1549

Website information:

<https://www.allergycosmos.co.uk/commercial-air-filtration/iqair-dental-pro/>
<https://www.allergycosmos.co.uk/media/pdf/iqair-dental-series-technical-specifications.pdf>

Location: Distributed in the United Kingdom, built in Switzerland

Radic8 VK401

Product statement:

The Virus Killer 401 is ideal for purifying and sterilising medium to large rooms. It combines pre-filter, HEPA filter, activated carbon and a reactor cell of 8 super UVC lamps, as well as 40 TiO2 hexagonal filters.

USPs:

- » 8 pcs UVC lamps (16W total), around 40 TiO2 hexagon filters, reactor cell lifespan 8000 hours, washable pre-filter, HEPA 13 (2000 hours duration), activated carbon filter (6000 hours)
- » Certified as a 'we share clean air' product
- » Can be mounted on wall or stand alone
- » Remote control to adjust air throughput
- » One of the higher UV-C capabilities
- » Market leading product — huge presence in Asian Markets

Price: £1200

Website information:

<https://radic8.com/vk401/>

Location: Distributed in the United Kingdom

Woodpecker Q7 high-pressure plasma air purifier

Product statement:

Woodpecker high pressure plasma air purifiers. High pressure electrostatic air purification technology can absorb particles and aerosols as small as 14.6nm. An electric field of 20,000 to 40,000 volts can effectively eliminate bacteria and viruses. The lab proves a virus killing rate for H3N2 influenza virus is 99.97% within 1 hour.

USPs:

- » 20-40kV electric field forces to actively capture pollutants
- » No need to buy and replace HEPA filters
- » Easy maintenance - washable electrode
- » TPA Technology – Innovative use of generator pole and collector pole to form a dust hunting airfield. Absorbs dust, smog and particles in the air.

Filtration:

- » Pre-filter - to remove large particles
- » Generator pole - positively charged plates kills bacteria and viruses
- » 20,000-40,000 volt sterilisation chamber to kill bacteria and viruses
- » Collector — collects the positively charged particles which have passed through pre-filter, generator pole and chamber
- » Catalytic device - absorbs odours and reduces carbon

NB: Woodpecker Q7 overlook the need for a HEPA filter (a valuable addition to any full air-quality solution) in favour of a more streamlined solution that is primarily reliant upon Air ionisation technology- a technology that comes as standard on 'Dent-air' costing a similar price.

Price: £960

Website information:

<https://www.ukdentalsupplies.com/product/woodpecker-high-pressure-plasma-air-purifier-q7/>

Location: Distributed in the United Kingdom

DentAir

Product statement:

DentAir is the ultimate air purification system, designed specifically with dentists in mind. Featuring an unprecedented 5-stage filtration system including Pre-filter, super HEPA filter, Carbon filter, UVC Sterilisation and Air ionisation system encouraging the safest possible environment for you and your patients. Assembled and distributed from here in the UK, combined with the quality and service that you have to come to expect from Bryant Dental.

USPs:

- » 5 stage filtration: pre-filter to remove large particles; super HEPA filter to remove particles larger than 2.5microns, carbon filter to remove dental odours and organic compounds and UVC and titanium dioxide catalyst to kill 99.99% of pathogens.
- » Completely encapsulated - designed with safety, quality and compliance in mind (<0.03ppm ozone production)
- » HEPA filter three times larger than competitors, and 4W more UVC capability than the next nearest competitor
- » In a standard sized surgery, it can usually operate at only 20-30% capacity in order to purify the air due to the extremely powerful maximum capacity of the unit.
- » REAKT™ (air kinetic technology) detects particulate count and modifies throughput accordingly, for example in aerosol generating procedures. Such a feature means the unit will never be operating at a noise level beyond what is necessary to provide healthy purified air in the surgery.

- » Throughput can also be adjusted preemptively with a wireless remote
- » Air quality audit compliant with app connectivity
- » The measured throughput of the 'Dent-air' is 600 m³ per hour, therefore assuming a 24m³ surgery, the air would be turned over 25 times/hour.
- » Specifically designed for the dental market with Bryant Dental customer service
- » Assembled in the United Kingdom - local repairs and no need for local distribution services minimises down-time
- » £48/filter replacement cost - unit informs you when replacement needed (depends on usage and environment e.g. pollen count)
- » Placement - 20cm away from a wall - allows 360 degree throughput and Venturi airflow design allows for improved circulation

Price: £995

Website information:

www.dentair.co.uk

Location: Assembled in the United Kingdom

	AIRVIA Pro 150	Dyson Pure Hot + Cold™	IQAir Dental Pro	Radic8 VK401	WoodPecker Q7High-Pressure Plasma Air Purifier	DentAir
Pre-filter	✓ (Additional purchase)	✗	✓	✓ (Washable)	✓	✓
HEPA- as rated by European standard EN 1822-1	✓ - H13	✓ - H13	✓	✓ - H13	✗	✓ - H13
Carbon	✓	✓	✓	✓	✗	✓
UVC	✓	✗	✗	✓ - 16W	✗	✓ - 24W
Range of action	550m³/h	290l/s	50m³/h to 400m³/h	141m³	70-110m²	600m³/h
REAKT™ (or similar)	✓	✓	✗	✗	✓	✓
Particulates filtered or removed	>0.1µm	≥0.1µm (99.95% of allergens and pollutants)	Website - (≥99% ≥0.3µm)	?	PM 2.5 >0.0146µm	See report
TiO2 filters	✗	✗	✗	✓ - Around 40pcs	✗	✓
Fan speeds	5	10	6	?	?	4 + ReAKT
Noise levels	30-70dB	<62dB	25-67dB	38-44dB	40-60dB	28-60dB
Attachments	Free standing	Free standing	Free standing	Wall mounted/ Free standing	Free standing	Free standing
Remote control	✓	✓	✓	✓	✗	✓
Air audit capability	✓	✓	✗	✗	✗	✓
App enabled	✗	✓	✗	✗	✗	✓
Air Ionisation capability	✓	✗	✗	✗	✓	✓
Dimensions	31.25x84 (dxh)	76.4x24.8x 24.8cm (hxlxw)	71x38x41cm	36.5x15.6x58.1 (hxdxw)	760mmx380mm x380mm	800mmx 300mm
Power usage	9.8-54.5W	36-1575W	20-135W	≤120W	110W	<60W
Weight	11.8kg	5kg	20kg	12.9kg	19.7kg	11.7kg

Why do we need air filtration?

When an individual in a surgery sneezes, coughs or even talks both small splatter and even smaller 'aerosols' are released. In aerobiology, the larger of the two, namely 'splatter' (>50 µm diameter), fall toward the ground on a rather steep trajectory (an arc shape) after leaving the individual, this means close proximity is required for transmission person to person. However, the release of aerosols (≤50 µm diameter) from an individual can travel much larger distances through the air and remain suspended within it for extended periods - only to be breathed in by unsuspecting and potentially susceptible individuals. These Bio Aerosols are described as 'airborne particles of liquid or volatile compounds that contain living organisms or have been released from living organisms'.

It is explained that because of the nature of dental procedures, notably the use of water as a coolant during the use of high-speed handpieces and in the removal of debris, those spending time in these environments are more likely to

contract such viruses. Particularly dangerous are the smaller particles of aerosols, those that are between 0.5 µm and 10 µm. These aerosols are capable of lodging themselves in deeper and smaller passageways of the lungs and are believed to carry the greatest risk of transmission of infections. Not only are the airborne aerosols present within the surgery itself but via convection currents, they can move freely around the entire dental practice. One study concluded that the extent of the contamination resulting from aerosolisation of the substrate in the oral cavity was much more extensive than previously thought and 'practically encompasses the whole room'.

Other reasons for low air quality in dental surgeries:

- 1. Use of strong cleaning products, which contain volatile organic compounds**
- 2. Methyl methacrylate and monomers**
- 3. Poor ventilation**

Air purifier technology

Mechanical filters:

- » Force air through a dense web of fine fibres that traps particles.
- » Filters can be subdivided by particle filtration efficiency and the size of particles removed
- » Mechanical filters alone do not help with gases or odour and can be expensive to maintain

1. Pre filters: required to remove large impurities from the air and acts as an initial purification step before the engagement of subsequent processes.

2. HEPA (high efficiency particular air) filters

- » Defined as a filter capable of capturing 99.97% of dust particles and other microbes in the air of 0.3microns diameter and higher
- » The filter structure involves an outer filter stopping and trapping larger particles, prior to the air approaching a second filter in which the more microscopic bacteria and debris are captured.
- » The HEPA filter does not in itself have any mechanism for sterilisation once these microorganisms have been captured.
- » Studies recommend the implementation of HEPA filters to filter contaminated air in treatment rooms within the current COVID 19 context because despite the COVID 19 virus being smaller than the HEPA filter, virus aerosols often agglomerate together making them large enough to become trapped by the HEPA filter. Viruses trapped within HEPA filters cannot multiply and will remain safely withheld within the unit until the filter is changed.

- » In order to prevent against possible transmission upon changing HEPA filters, it is important to wear the appropriate PPE when doing so.
- » Ultra-low particulate air (ULPA) filters may have an efficiency even higher than that of the HEPA filter, with reported values at 99.999%, but these are not yet in widespread use.
- » NOTE: HEPA TYPE OR HEPA LIKE have not been certified to meet the requirements of a true HEPA filter

3. Adsorption - Activated carbon filters:

- » Rather than catch particles like mechanical filters, sorbent filters use activated carbon that can adsorb some odour-causing molecules and gas pollutants from the air. They are not particularly effective against formaldehyde, ammonia, or nitrogen oxide.
- » These filters enable gases to become trapped on a highly porous bed of charcoal and are particularly effective in removing mould and dust from the air.
- » Whilst a key filter, no sanitisation or elimination of living organisms occur within this filter.
- » This filters' efficiency is variable and VOCs attach to the filter so over time its efficiency reduces and the filter requires regular replacement. Humidity has also been shown to reduce the efficacy of carbon filters.

Air purifier technology (continued)

UV-C filter:

- » Once the air has travelled through the above filters, it may be exposed to UV-C light.
- » Extremely effective at destroying genetic material - It is hence that UV-C emitting bulbs are crucial to any effective air purification units' internal technology.
- » The disinfection process is called germicidal irradiation - this is largely dependent on the intensity of the light, the duration of exposure of the microorganism and the humidity of the room.
- » This reaction can sometimes generate harmful byproducts, such as ozone, formaldehyde, nitrogen dioxide, and carbon monoxide.
- » Importantly, UV-C emitting bulbs within air purification units are not released externally, outside the constraints of the unit's internal infrastructure, meaning their use is considered safe to the use.

Air ionisation and electronic air purifiers:

- » Air ionisation utilises the chemical properties of ions. The ioniser generates ions using electricity and releases them into the surrounding air. Such ions are negatively charged and as such are attracted to positively charged particles (namely the pollutants in the air) thus resulting in the creation of heavier particles. By way of gravity, these newly formed particles fall to the ground or surface and no longer contaminate the air breathed.
- » It is consequently necessary to wipe surfaces (including the floor) regularly to remove these newly formed heavier particles from the environment.
- » They have also been implicating in producing ozone.

Ozone generators:

- » These machines produce ozone, a molecule that can react with certain pollutants to alter their chemical composition. This can result in dangerous indoor air quality and are not recommended
- » Makers of ozone generators often claim that the devices emit safe levels of ozone, but in the historic studies have found that even at low settings, some ozone generators quickly exceeded Public Health England safe levels
- » Studies reviewed by the EPA have shown that low levels of ozone — the chief ingredient of smog — don't effectively destroy indoor pollutants.

Air purifier technology (continued)

- » Studies also show that ozone has been linked to decreases in lung function and increased risks of throat irritation, coughing, chest pain, and lung tissue inflammation. Ozone might also worsen asthma, emphysema, and bronchitis, according to the EPA.
- » Can affect polymers resulting in degradation and discolouration

Plasma

- » This method of purification relies on the use of high voltages to eliminate particulate matter and microorganisms using redox reactions and precipitation. There have been reports of efficacy of up to 95% in the elimination of bacterial and fungal species. However, this is not yet commonly found in commercial units due to poor energy efficiency and the formation of nitrous oxides and ozone

and this could lead to a risk of accumulation of bacterial colony forming units and viruses on the filter and redistribution. In combination with UVC irradiation, HEPA filtration is able to eradicate microorganisms which pass through the unit. However, neither is effective in the removal of VOCs such as odours from the air which can be unpleasant for both practitioner and patient, the addition of a carbon filter to this base technology could resolve this issue.

The HEPA filter was shown in all studies to be effective in removing the largest proportion of particulate matter from the air and greatly reducing the time interval in which these contaminants remain airborne. It has also shown efficacy in removing micro-organisms from the air, however, it is not able to inactivate them

Considerations when purchasing an air purifier for a dental surgery

1. Air purifier technology contained within the unit (refer to the comparison table)

Traditional air purification units tend to rely upon a small number of the above solutions, usually focusing upon HEPA filters as their primary defence against suspended particulates, alongside a carbon filter to remove odours. Despite HEPA filters being described as 'highly effective technology', these two filters alone are unable to kill bacteria and viruses. A solution should be sought that benefits all filters and technology.

2. Size of space

Many products claim to be able to purify the air within rooms up to 24 m², however important to understand is the lack of a **standard measure** by which to verify or disprove this purification capacity claim. For example, a unit expressing the above claim may only be capable of 'turning-over' the air within the said room of 24 m² – three times an hour. One study, however, concluded that to drive down the risk to those breathing the contaminated air, a dental surgery should have its air turned over more than 15 times per hour.

Current COVID infection prevention and control guidelines issued by the UK government indicates there should be a minimum of six air changes per hour in general wards to ensure safe entry without the need for a class 3 filtering face mask. To avoid such confusion, a more informative metric by which to measure the maximum capability of a unit to purify the air would be to measure its potential throughput by m³ per hour (UK) or feet³ per hour (US), it is, therefore, possible to calculate how many times your dental surgery would have its air changed per hour based on the dimensions of the room and quoted maximum throughput of the purifier.

3. Maximum capacity of a unit

The maximum capability of a unit is extremely important to consider for two reasons. Firstly, for noise-related reasons, your unit should be working at merely a derivative of its maximum capacity for large portions of the day. Otherwise, the noise generated by an overstretched unit shall be distracting to its user. Secondly, a powerful unit shall have to be run at full capacity for less time than that of a weaker product when it gauges new pollutants in the air. The air will also be cleared of impurities much quicker as well as more thoroughly.

Considerations when purchasing an air purifier for a dental surgery (continued)

4. Number of air purifier units required throughout a dental practice

Due to the ability of suspended particulate matter to travel via convection currents from one room to another, it is necessary to implement air purification units in each surgery facility within the practice. Furthermore, a detailed study found that positioning of air purification units within the surgery itself could have an extremely significant impact on the quantity of potentially harmful droplets/aerosols entering a DHCW's (Dental Healthcare Worker's) 'breathing zone. With this in mind, it is not only important to have a unit in each surgery, but the unit must also be located in a strategic position within the surgery to reduce risk most effectively.

5. Price of HEPA and activated carbon filter replacements

6. Repairs and down time




7. Customer service

8. Certifications

9. Clean air delivery rates - CADR reflects, in cubic feet per minute, the volume of clean air that an air purifier produces on its highest speed setting. Above 240 is an excellent rating

10.Noise - These machines should always be running, so ideally they should also be quiet. For reference, a noise rating around 50 decibels is roughly equal to that of a refrigerator



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