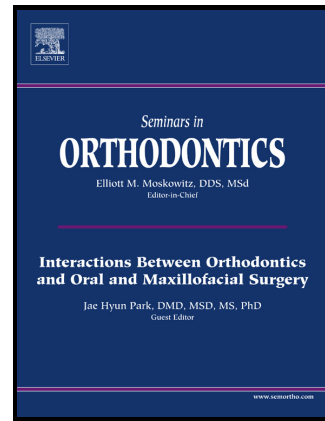


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Inventory management and analysis in an orthodontic practice

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## Inventory Management and Analysis in an Orthodontic Practice

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**Abstract:** Inventory is a word very frequently used yet most often never practiced, in the true sense, by the practitioners of orthodontics. This article clears the mist around the word “inventory” and provides simplistic explanations regarding maintaining and managing inventory in day to day clinical practice. Inventory is always dynamic; it is recommended that every individual / practice is different and it is important to individualize the ways and means of maintaining an inventory and making it work positively towards a successful practice.

Investing in good inventory software and delegating the responsibility to a specific person with careful monitoring by the Orthodontist is important. The key operative word for inventory management is `Neither Too Much, Nor Too Less`.

**Key Words:** Inventory management, Supply Chain management, Orthodontic practice

“Our mind takes an inventory of past events and uses them to project the probability of success in the future. Depending on the information it gathers, we either move forward- or the fear response is triggered and forward progress is circumvented.” Page 48 -- Nick Ortner

### **Introduction:**

Sometimes the technical jargon used complicates matters for a practicing orthodontist, who wants to use the “KIS” (keep it simple) principle for even something which in academic terms has little relevance but cannot be ignored in day to day practice. Inventory is the life blood of any supply chain or in our case, any practice. It is imperative to know each part of this supply chain and be able to account for its proper utilization to be able to maintain a balance between all aspects of material purchase, utilization and stocks to run a successful practice. Most practitioners have their individual methods which range from being arbitrary to specific software dependent. This is our attempt to simplify and sequentialize a relative non-orthodontic process for the orthodontist.

### **What is Inventory?**

*Inventory* is an idle stock of physical goods that contain economic value, and are held in various forms by an organization in its custody awaiting packing, processing, transformation, use or sale in a future point of time.<sup>1</sup> In simpler terms, this includes everything that an orthodontist uses in his/her practice, on a patient as well as in the practice for administration or record maintenance.

Any practice will have to hold inventory (Table 1) of all products/materials used in day to day practice ranging from hand disinfectants to brackets and bands. Any inventory can be in a *complete state* (e.g. pre-welded bands with tube) or in an *incomplete state* (e.g. molar bands and molar tubes). This inventory is held to facilitate future consumption, sale or further processing/value addition. All inventoried resources have economic value and can be considered as assets of the practice.

### **Inventory management fundamentals:**

Manufacturing companies like computer manufacturing or mobile phone manufacturers call the model by name VMI - Vendor Managed Inventory while Automobile industry uses the term JIT - Just In Time where as apparel industry calls such a model by name - ECR - Efficient consumer response.<sup>2</sup> The basic underlying model of inventory management remains the same. The VMI model is the most accepted and most large practices prefer to have good relations with specific vendors and distributors of products of their regular use or preferences and procure as per their needs. This model is mutually beneficial as the vendor is assured of regular business and the practices are not required to maintain large stocks. Yet, individual practices, depending upon multitude of factors varying from their location to assess ability to individual preferences might choose different methods for different products.

Inventory management is extremely important primarily because it determines the quality of a practice, to an extent and, for a fact which many orthodontists might not be aware of, as it impacts the financial health of the balance sheet. Every practice ought to strive to maintain an optimum inventory to be able to meet its requirements and to avoid over or under inventory that can impact the financial figures. Holding inventories helps practices to remain independent and free from vendor dependencies as well as prevents discontinues in services providers.

**Inventory costs** are the costs related to storing and maintaining an inventory over a certain period of time. Inventory costs are basically categorized into three headings: 1) ordering cost, 2) carrying cost and 3) shortage or stock out cost and cost of replenishment. Let us for example work with the simple example of bracket kits. The *ordering cost* would be the cost of procurement and inbound logistics costs. Ordering excess quantity will result in carrying cost of inventory. Whereas, ordering less will result in increase of replenishment cost as these kits might work out to be cheaper when procured in bulk or at conferences. Also buying smaller quantities can add significant shipping costs which would add to the carrying cost. Also, in case a lack of kits might adversely affect start-up as there might be a delay in supply from the vendors, which will be categorized as *shortage* or *stock out cost*. Inventory storage and maintenance involves various types of costs namely: *inventory storage cost* and *cost of capital*. Inventory carrying involves inventory storage and management either using in house facilities or external warehouses owned and managed by third party vendors, these are not so important for small items but might be of importance for products and materials which occupy large amounts of space for storage and typically include cost of building rental and facility maintenance and related costs. Cost of capital includes the costs of investments, interest on working capital, taxes on inventory paid, insurance costs and other costs associate with legal liabilities. In other words, in addition to the money originally spent to purchase inventory, more money is required to be spent on upkeep while the inventory is in your possession. The longer the inventory is there, the more it will cost in upkeep. Carrying cost is usually expressed as a percentage that represents the cents per dollar that will be spent on inventory overhead per year. Or simply put the cost of the bracket kits that we bought in bulk but because of a lack of enough start-up they are still unused and since they have been paid for in full at the time of purchase they are not just occupying space but the money used for their purchase could well have been invested somewhere else and used to generate revenue.

Hence, an inventory is always dynamic. Inventory management requires constant and careful evaluation of internal and external factors, control through planning and constant review. It is important for smooth functioning of the practice that this be the part of someone's job description. Although everyone should be knowledgeable about the products they routinely use, a point person should do the actual supply ordering with the clinician in the loop about all products ordered.

The purpose of maintaining an inventory in successful operations:

- a. Meeting customer demand: Maintaining an inventory allows a practice to immediately fulfill customer demand for that product. Failing to maintain an adequate supply can lead to disappointed potential customers and lost revenue.
- b. Protecting against supply shortages and delivery delays: A supply chain is only as strong as its weakest link, if a practice is not regularly ordering the same product it is likely that the vendor might not stock it and there might be delays in procuring the same.
- c. Smoothing production requirements and reducing peak period capacity needs: Practices should ideally stock up on nonperishable products like brackets or molar bands which do not have an expiry based on their experience of seasonal customer demand as during school holidays.
- d. Taking advantage of quantity discounts: Many suppliers/companies offer discounts based on certain breaks because large orders tend to reduce total processing and shipping costs while also allowing suppliers to take advantage of economies of scale in their own production processes. These are usually applicable at major specialty conferences or trade fairs.

In any business there are five types of inventory which needs to be considered.

**Raw Materials:** These are the materials or goods purchased by the manufacture. Manufacturing process is applied on the raw material to produce desired finished goods,

for example, cold cure acrylic powder.

**Work-In-Progress (WIP):** These are the partly processed raw materials lying on the production floor. They may or may not be saleable. These are also called semi-finished goods. From a practice point of view, these could include unfinished acrylic appliances. This level of this inventory should be kept as low as possible. Since, a lot of money is blocked over here which otherwise can be used to achieve better returns.

**Finished Goods:** These are the final products after manufacturing process on raw materials. They are sold in the market. There are two kinds of manufacturing industries. One, where the product is first manufactured and then sold. Second, where the order is received first and then it is manufactured as per specifications. In the first one, it is inevitable to keep finished goods inventory whereas it can be avoided in the second one.

**Packing Material:** Packing material is the inventory used for packing of goods. It can be primary packing and secondary packing. Primary packing is the packing without which the goods are not usable. Secondary packing is the packing done for convenient transportation of goods.

**MRO Goods:** MRO stands for maintenance, repairs and operating supplies. They are also called as consumables in various parts of the world. They are like a support function. Maintenance and repairs goods like bearings, lubricating oil, bolt, nuts etc. are used in the machineries used for production. Operating supplies mean the stationery etc. used for operating the practice.

How inventory is valued? Inventory valuation is the cost associated with an entity's inventory at the end of a reporting period. It forms a key part of the cost of goods sold calculation, and can also be used as collateral for loans. This valuation appears as a current asset on the entity's balance sheet.

When valuing Inventory, one should adopt and consistently use a cost-flow assumption regarding how inventory flows through the entity. Examples of cost-flow are:

- The specific identification method, where you track the specific cost of individual items of inventory.
- The first in, first out method, where you assume that the first items to enter the inventory are the first ones to be used for example bonding material. These items usually have an expiry and cannot be held beyond a specific period of time.
- The last in, first out method, where you assume that the last items to enter the inventory are the first ones to be used. For example, that if brackets are the most recently purchased item then they should be consumed the earliest.
- The weighted average method, where an average of the costs in the inventory is used in the cost of goods sold. The number of kits utilized in a given time should ideally collaborate with the number of new start-ups.

Whichever method you choose will affect the inventory valuation recorded at the end of the accounting period. And, ideally multiple methods need to be used for different products consumed in a practice.

When looking at a company's current assets, you need to pay special attention to the inventory as an inventory consists of merchandise a business owns but has not sold. It is classified as current assets because investors assume that inventory can be sold in the near future, turning it into cash. For example, bracket kits. These can be bought at a discount in bulk and stored over a period of time. But in case they remain un-utilized or in other words when inventory piles up, it faces two major risks: the first is the risk of obsolesce. Some goods become obsolete as time passes and technology makes them redundant or makes them lose value over a period of time. For example, if pre-adjusted

bracket kits were bought and stored in large numbers and the practitioner shifted his practice to a self-ligating appliance, these kits lose value and are unlikely to be consumed to start cases leading to loss of revenue. They will have to be either discarded or sold at a highly discounted prices. Secondly, an inventory is at risk of spoilage. Spoilage occurs when a product actually goes bad. This is a serious concern for companies that make or sell perishable goods, usually involves chemical items like bonding agents and luting cements.

"Inventory control is the process whereby the investment in materials and parts carried in stocks is regulated, within pre-determined limits set in accordance with the inventory policy established by the management." – Gordon Carson

*Inventory control* is a method where all stocks of goods are properly and promptly issued, accounted, and preserved in the best interest of an entity that handles its inventory (Table 2).

### **Uncertainty in inventory processes**

Zipkin (2000)<sup>3</sup> states that "most of the important functions of inventories can be understood in terms of the various types of mismatches that arise between supply and demand processes." Typically, these processes cannot be matched perfectly — as a result, inventory acts as the buffer between them to reduce the effect of their incompatibilities. As expected, conflicts often arise. The most common of these is a shortage — the failure to meet demand when it occurs. Thus, one primary function of inventory is to prevent or limit shortages. Consider some of the characteristics of supply and demand processes that Zipkin suggests can contribute to this inherent incongruity:

### Supply

- economies of scale (production and delivery)
- capacity limits (production and delivery)
- delays in replenishment (order lead time)

### Demand

- Steady or intermittent demand
- variations in demand over time (trend, seasonality)
- unpredictable demand variations (random)

Each of these factors can contribute to uncertainty. When dealing with uncertainty, the traditional objective of inventory control models is to minimize expected costs.

### **Inventory replenishment processes**

The two processes of replenishment and inventory are closely related. The inventory planning process establishes the optimal inventory levels that must be maintained to meet expected service levels for demand fulfillment. What does that exactly mean? To understand we need to explore the replenishment (or re-ordering) process.

Reordering or replenishment process needs to define review period for reordering, and an ordering quantity.

The two key inputs to optimally run the reordering processes above are the inventory safety stock and reorder levels. **(Fig. 1)** These parameters control two of the most critical factors in a supply chain, the amount of inventory, and the ability to maintain favorable service levels. And both of these are defined by the inventory planning process. As the demand and supply patterns change, the optimal inventory levels required to guarantee desirable service levels also change. Due to inherent variability in the demand and supply streams at any supply chain node, the

ability to service demand directly depends on the safety stock. The relationship between the two is exponential that means that a 100% guarantee to fulfill demand will, in theory, require an infinite amount of safety stock to be maintained.

A good inventory planning process helps define these levels, discriminating between products that require higher service levels versus those that don't. It helps in maintaining user defined service levels that guarantee desirable fill-rates to fulfill the demand. It also reviews them frequently to make changes to the safety stock recommendations to adjust to the new demand/supply picture.

### **Forecasting**

Forecasting is making an informed prediction about placing an order. Using forecasting models such as determining reorder points and economic order quantities can help ensure optimal inventory control.

Certain boundaries have to be set in place to give the most accurate outcome:

**Forecast period** A forecast period is a specific amount of time which decides the forecast quantity.

**Trend** A trend is an increase or decrease in demand over a certain period of time. Identifying one such trend makes it easier to project future sales.

**Base demand** The base demand is simply the starting point for a forecast (i.e. current demand).

Forecasting is in turn linked to determining reorder points and order quantities, both of which are critical to optimizing inventory control.

### **ABC Inventory classification (Fig.2)**

An important aspect of managing inventory is to have a way to classify it based on its importance. All items in the Inventory are not of equal importance. Some are very important, such as Orthodontic brackets. Others are less important, such as weldable eyelets in an orthodontic office. The first step in managing inventory is to classify inventory based on its degree of importance to manage it properly. The tool for this is ABC classification. Classifying inventory based on degree of importance allows us to give priority to important inventory items and manage those with care. It also prevents us from wasting precious resources on managing items that are of less importance.

ABC classification is based on Pareto's Law, which states that a small percentage of items accounts for a large percentage of value. This value can be sales, profits, or other measure of importance. Roughly 10 percent to 20 percent of inventory items account for 70 percent to 80 percent of inventory value. These highly valuable items are classified as A inventory items. Moderate value items account for approximately 30 percent of inventory items and contribute to roughly 35 percent of the total. They are called B items. Finally, approximately 50 percent of the items only contribute to roughly 10 percent of total inventory value. These are called C items and are of least importance.

### **Inventory record management**

Inventory systems allow you to keep track of and make sure your inventory records are up-to-date. There are two main types of inventory systems that you can choose for your business; either a periodic or perpetual inventory system.<sup>4</sup>

#### **Periodic inventory systems**

In a periodic inventory system, you don't update your inventory records straight after your inventory levels change. Instead, you update them time-to-time by physically counting your

inventory by doing a stock take.

Advantages of periodic inventory systems include:

- being less costly to set up than a perpetual inventory system
- Cheaper to run than a perpetual inventory system

### **Perpetual inventory systems**

In a perpetual inventory system, you update your inventory records straight away after your inventory levels change. Perpetual inventory systems are often electronic and use a point-of-sale system.

Some benefits of perpetual inventory systems are:

- better detection of theft
- more up-to-date records

The first step in inventory control organization is to streamline inventory management. An *inventory system* is a list of the stock and assets in the dental office. This list is divided into two parts, capital equipment and expendable and nonexpendable supplies. Its important to become familiar with the types and quantities of products and materials used in the office. Also bone has to be quickly familiar with the monetary value of the current inventory and what the minimum and maximum quantities of the products are for the office.

Some offices use an index card system, a notebook, or a visible record system. It does not matter which type of system you use as long as you have one. Offices who do not record prices and orders invariably incur higher costs. A smart shopper will record the following information:

1. Name of the company
2. Name of the product
3. Telephone number
4. Address
5. Amount normally ordered
6. Price of the last order
7. Frequently ordered
8. Amount on back order
9. Location of the supply

This information can be used as a bargaining tool during price negotiations. The sales representatives quote the lowest prices to those who drive the hardest bargain.

Another good reason to have a system in place is for training purposes. If the person in charge of ordering leaves the practice, everything is recorded.

A diagram of the location of the supplies should be set up also. Divide the office into different areas and make a list of which supplies are located in each area. I feel a walk-in closet is ideal for storing supplies. Not every office has this convenience, therefore, a supply location system would aid many practices. If you are planning to build a new office, it is recommended finding room in your plans for a nice size walk-in closet with open shelves. This is the most efficient means of storing supplies. It is easy to determine with a quick glance what needs to be reordered.

### **Taking a physical inventory**

Many offices are interested in taking an annual physical inventory. A simple way of doing this annually is by counting all of the supplies in stock. Record the date and the number. As you

order, record the number ordered. In one year, count again the number in stock. Add the number you had on hand originally and the number ordered throughout the year. Subtract the final number on hand at the end of the year from that total. This will give the number used during the year. This system will enable you to order in bulk efficiently.

### **When to Reorder**

Most offices actually use a three-way system for reordering. First, they keep a main reorder list where everyone can record if a supply needs to be reordered. Second, the person in charge of ordering checks the stock once a week. Third, some offices tag reorder points. When a staff member takes the supply with the tag attached, she gives the tag to the person in charge of ordering supplies. Flagging reorder points is also effective for business supplies.

Purchase order forms can be very effective for multiple office practices. If a main supply area is supplying several satellites, make supply requests, in writing, on a purchase order form. These forms should be filed in a manila file folder for the year according to the different offices. At the end of the year, it is simple to determine how much of each supply was used in the various satellites. This simplifies bulk ordering.

### **Automated Inventory Systems**

An automated inventory system can be created through a special software package or database created individually. The system can be simple or complex. An automated inventory system set up in a centralized database allows the staff simply to enter the shipment data into the system and print new inventory reports. The system enters the inventory numbers in the accounts automatically, as long as the information is entered correctly. A simple system like this, done in the office, can work as effectively in some offices as a dealer inventory management system.

Many orthodontic suppliers provide inventory management systems for their customers.

## Storage and Protecting Inventory

In a utopia, no one would worry about the possibility of inventory being stolen or destroyed. But unfortunately, it's a very large reality for small businesses. It can be difficult to tell if inventory shrinks due to waste, breakage, or theft, but it's possible to distinguish the reasoning behind loss.

The first thing on your list should be to make sure that your staff knows and is required to record all waste and breakage and report about the same.

After you've identified waste and breakage, most of the loss is probably due to theft. There are a few inventory managing techniques you can use to help keep an eye on your inventory.

1. To prevent theft of materials from the storage, install security cameras and train your employees about how to recognize and prevent loss.
2. Only allow extremely well trained and very trusted employees to edit data in your inventory management lists or software. It's very, very easy for an employee to change a few numbers in the inventory software so that the Orthodontist never realizes products are gone. Many software systems require a unique login for each user; therefore, updates to inventory can be tracked by each specific user who logs in.
3. Similarly, it's a great idea to password protect your entire inventory tracking software. You should choose to only give the password to specific and trusted employees who deals directly with your inventory. Make sure that the user ID and password is unique to each and every individual that has access.

4. Store your inventory in a very secure place. Only allow very specific employees access to the most expensive inventory items. Then they are held accountable for those specific items. You can often utilize a specific spot (even a safe) within your warehouse for the most expensive and important inventory items.

5. Insure inventory.

Be active when it comes to protecting your inventory. Safe belongings equal secure belongings. Inventory theft can occur internally or externally, so ensure that you have the best policies and devices to keep as much inventory safe.

### **Economic Order Quantity (EOQ)**

In 1915, F. W. Harris of General Electric developed the Economic Order Quantity formula (EOQ) to help stock keepers in determining how much product to buy.

To calculate EOQ, assume:

A = Total Value of SKU Per Year

K = Carrying Cost (The K Factor)

R = Replenishment Cost (The R Factor)

P = Price Per Unit

Basic Formula:

This formula and its variations allow you to determine the following:

- the optimal quantity to order
- when it should be ordered
- the total cost
- the average inventory level

- how much should be ordered each time
- the maximum inventory level

The EOQ model is based on several assumptions:

- the demand rate is constant (no variations), recurring, and known.
- the carrying cost and ordering cost are independent of the quantity ordered (no discounts).
- the lead time is constant and known. Therefore, the ordering times given result in new orders arriving exactly when the inventory level reaches zero

The economic order-quantity model considers the tradeoff between ordering cost and storage cost in choosing the quantity to use in replenishing item inventories. A larger order-quantity reduces ordering frequency, and, hence ordering cost/ month, but requires holding a larger average inventory, which increases storage (holding) cost/month. On the other hand, a smaller order-quantity reduces average inventory but requires more frequent ordering and higher ordering cost/month.<sup>5</sup>

Inventory ordering and usage occur in cycles. A cycle begins with receipt of an order of  $Q$  units, which are withdrawn at a constant rate over time. When the quantity on hand is just sufficient to satisfy demand during lead time, an order for  $Q$  units is submitted to the supplier. Because it is assumed that both the usage rate and the lead time do not vary, the order will be received at the precise instant that the inventory on hand falls to zero. Thus, orders are timed to avoid both excess stock and stockout (i.e., running out of stock).

While EOQ may not apply to every inventory situation, most organizations will find it beneficial in at least some aspect of their operation. Anytime you have repetitive purchasing or planning of an item, EOQ should be considered.

## Conclusion

Management of inventory is very important for successful management of an Orthodontic practice. Inventory is a variable cost which if controlled scientifically and in organized matter can help an Orthodontic practice achieve profitability.

The key element is to understand the importance inventory plays and incorporation of inventory management systems that is best suited for the practice. **(Table 3.)**

Investing in good inventory software and delegating the responsibility to a specific person with careful monitoring by the Orthodontist is important.

“You can’t control what you don’t measure.” Peter Drucker.

The key operative word for inventory management is `Neither Too Much, Nor Too Less`.

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#### **IMAGE LEGENDS**

FIGURE 1 - Relation between service level and safety stock

FIGURE 2 - ABC Analysis

Accepted manuscript

**Table 1: Why do practices need to hold inventories?**

Meet variations in consumptions.

Cater to cyclical and seasonal demands.

Economies of scale of procurement.

Take advantage of price increase and quantity discounts.

Reduce transit costs and transit times.

Long lead and high demand items need to be available when required.

**Table 2: 5 points to achieving inventory control:**

1. Purchasing items of the right-quantity, at the right-place and at right-time.

2. Providing a suitable, secure, and sufficient place for storage.

3. Developing a proper inventory identification system.

4. Maintaining an up-to-date record keeping.

5. Making proper requisition procedures.

Table 3: Key Points to Inventory Management
* Delegate Inventory Management to frugal and most organized staff member
* 1-2 hours per week for inventory system
* Analyze practice statistics and indulge in informed buying
* Take advantage of bulk discounts
* Don't waste time ordering in very small quantities
* Set-up annual budget based on previous year spends
* Analyze purchases
* Check stock levels monthly
* Always record prices at which goods are bought
* Use purchase order forms or order in writing / mail